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David Taylor Research Center

Bethesda, MD 20084-5000

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Proposed Draft Military Specification for Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)

by
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The report summarizes recent activities in the Department of Defense and in the US Navy, Army, and Air Force to establish Service use of Interactive Electronic Manuals (IETMs) as replacements for paper Technical Manuals for logistic support of military equipment.

The IETM concept is described, and an overview is provided of five IETM acquisition Specifications and Military Handbooks developed by the Tri–Service Interactive Electronic Technical Manual Working Group established in 1989 by the Defense Quality and Standardization Office.

One of these five draft documents, MIL–D–IETMDB Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMS), 1 Jun 1990, is described and presented. (Four other companion Reports have been prepared to introduce and describe the four related IETM acquisition Specifications and Handbooks.)

This report introduces the concept of the Revisable IETM Data Base, which serves as the basis for the construction of View Packages and as a source of other system–related logistics–support Technical Information required by various IETM users in a number of different activities throughout each Service. The primary constituents of the Data Base are described: (1) the Data Entities, which constitute the technical data contained in the IETDB; (2) the "attributes," which provide relevant technical data concerning Data Entities; and (3) the relationships, which provide the linkages among the Data Entities of the IETMDB. (see reverse side) OVER

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Required data access and data interchange features of the IETMDB are summarized, and the functions which the Data Base must support are enumerated.

A copy of MIL–D–IETMDB is included in this report as an Appendix.

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CONTENTS

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ABSTRACT

This Report summarizes recent activities in the Department of Defense and in the US Navy, Army, and Air Force to establish Service use of Interactive Electronic Technical Manuals (IETMs) as replacements for paper Technical Manuals for logistic support of military equipment.

The IETM concept is described, and an overview is provided of five IETM acquisition Specifications and Military Handbooks developed by the Tri-Service Interactive Electronic Technical Manual Working Group established in 1989 by the Defense Quality and Standardization Office.

One of these five draft documents, MIL-D-IETMDB, *Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)*, 1 Jun 1990, is described and presented. (Four other companion Reports have been prepared to introduce and describe the four related IETM acquisition Specifications and Handbooks.)

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    (1)   the Data Entities, which constitute the technical data contained in the IETMDB;

    (2) the "Attributes", which provide relevant technical data concerning the Data Entities; and

    (3) the "Relationships" which provide the linkages among the Data Entities of the IETMDB.

Required data access and data interchange features of the IETMDB are summarized, and the functions which the Data Base must support are enumerated.

A copy of MIL-D-IETMDB is included in this Report as an Appendix.

ADMINISTRATIVE INFORMATION

ACKNOWLEDGEMENTS

1.0 INTRODUCTION

1.1 BACKGROUND

During the 1980s, it became increasingly apparent that the striking increases in the complexity and sophistication of the weapon systems of all three Services were causing a serious lag in the production, distribution, and management of the Technical Information required to maintain, operate, and support these systems. Of particular concern were increasing weight and space requirements resulting from the increasing bulk of the required paper Technical Manuals.

At the same time, a number of significant technological improvements were being made in the field of information handling, particularly the advent of small, inexpensive, fast computers. Such innovations offered the potential of almost complete replacement of paper-based Technical Information through the use of light, easily stored, highly capable electronically processible media, which at the same time were capable of more effective interactive display to the end user.

Research, Development, Test, and Evaluation efforts of the three Services during this past decade have conclusively demonstrated, both through field tests and through in-house analyses and experimentation, the feasibility and intrinsic value of providing integrated Technical Information in paperless form in such a way that it can be displayed to end users by means of an interactive Electronic Display System.

For example, the Navy Technical Information Presentation System (NTIPS) Program at David Taylor Research Center, the Navy's Lead Laboratory for TI automation, demonstrated under operational conditions the improvements achievable in maintenance-technician performance [Refs (1) and (2)] through the use of electronically displayed TI. Similar results have been achieved by the Air Force under its Computer-based Maintenance Aiding Information System (CMAS) and its Integrated Maintenance Information System (IMIS) programs [Refs (3) and (4)]. The Army has automated Training Information under its Electronic Information Delivery System (EIDS), and has assessed the capability of using field portable maintenance aids under the Militarized Electronic Information Delivery System (MEIDS) program.

In addition, a number of pilot prototype developments and tests involving land, sea, and air vehicles and their weapon systems are being carried out, by individual System Acquisition Managers of all three Services, in an effort to provide interactive and electronically displayed Technical Information.

Ref (1) Fuller, Joseph J., Theodore J. Post, and Anne S. Mavor, "Test and Evaluation of the Navy Technical Information Presentation System (NTIPS), F-14A Field Test Results," DTRC-88/036 (Sep 1988).

Ref (2) Fuller, Joseph J., Raymond L. LeBeau, Anne S. Mavor, Theodore J. Post, and Charles S. Sawyer, "Test and Evaluation of The Navy Technical Information Presentation System (NTIPS), AN/SPA-25D Test Results," DTRC-88/035 (Sep 1988).

Ref (3) Thomas, D.L. and J.D. Clay, "Computer-Based Maintenance Aids for Technicians: Project Final Report," Air Force Human Resources Laboratory, AFHRL-TR-87-44 (Aug 1988).

Ref (4) Link, W.R., J.C. Von Holle, and D. Mason, "Integrated Maintenance Information System (IMIS): A Maintenance Information Delivery Concept," Air Force Human Resources Laboratory, AFHRL-TP-87-27 (Nov 1987).

1.2 DOD AND TRI-SERVICE PROGRAMS ESTABLISHED IN RESPONSE TO TECHNICAL INFORMATION AUTOMATION POLICY

To coördinate and standardize the increased use of computer-aided logistic support throughout the three Services, the Department of Defense established the Computer-aided Acquisition and Logistics Support (CALS) program [see Ref (5)], which also has had a wide effect in stimulating progress toward the goal of TI automation, and particularly toward standardization of such efforts.

The Department of Defense established [Ref (5)], and later reiterated [Ref (6)], a policy requiring that access to and the delivery of system-related logistic-support information be automated.

For example, Ref (6) provided the following directions:

a. For systems now in full-scale development or production, program managers were required to review specific opportunities for cost savings or quality improvements that could result from changing delivery or access using the Computer-aided Acquisition and Logistics Support standards.

b. For systems entering development after September 1988, acquisition plans, solicitations, and related documents

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Ref (5) DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS, of 24 Sep 1985. Subj: Computer Aided Logistic Support.

Ref (6) DEPSECDEF MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS AND DIRECTOR, DEFENSE LOGISTICS AGENCY, of 5 Aug 1988. Subj: Computer-Aided Acquisition and Logistic Support.

required specific schedule and cost proposals for:

(1) integration of Contractor Technical Information systems and processes;

(2) authorized Government access to Contractor data bases; and

(3) delivery of Technical Information in digital form.

c. DOD components were to program for automated systems to receive, store, distribute, and use digital weapon-system Technical Information, including achieving the earliest possible date for digital input to DOD engineering data repositories.

More recently, the Joint Uniform Service Technical Information System (JUSTIS) concept has been announced, a planned effort which will combine, to as great a degree as possible, Tri-Service procedures and equipment for acquisition and control of system-support Technical Information.

1.3 THE INTERACTIVE ELECTRONIC TECHNICAL MANUAL CONCEPT

The culmination of this effort throughout the 1980s in response to the DOD policy statements cited has been the development of the Interactive Electronic Technical Manual (IETM) Concept. The IETM Concept involves full application of existing technological capabilities to the problems of providing Technical Information which is both more effective for the end user and more efficient in terms of acquisition, control, and update.

The IETM Concept involves a system approach, which includes basically all of the following components:

a. A standardized, automated, revisable source Data Base.

b. Use of a computer-controlled authoring system.

c. The generation of digital Technical Information (containing text and graphics), either directly by an Author, or automatically by computer. This Technical Information is recorded on an electronically processible medium (optical or magnetic), rather than on paper.

d. Technical Information (consisting of task-related increments) which is optimally arranged and formatted for interactive screen presentation.

e. Presentation (display to the end user) by means of a computer-controlled Electronic Display System (EDS) possessing an extensive user-interaction capability. The EDS is capable of displaying the IETM, performing related logistic-support functions, and interfacing with other Service logistic-support Information Systems.

An IETM permits a user to locate required information more easily, and to present it faster, more comprehensibly, more specifically matched to the configuration, and in a form that requires much less storage than paper. Powerful troubleshooting procedures not possible with paper Technical Manuals are possible using the computational capability of the IETM Display Device.

IETMs will be used by maintenance technicians, afloat and ashore; to maintain and operate weapon systems by Intermediate and Depot maintenance activities; and by training personnel.

The IETM Concept has been described in detail in Ref (7).

1.4 PREPARATION OF SPECIFICATIONS AND HANDBOOKS FOR SERVICE-WIDE COORDINATION OF ACQUISITION OF AUTOMATED TECHNICAL INFORMATION

To coordinate this wide-spread effort, the Defense Quality and Standardization Office established in 1989, under the DOD Technical Manual Technology Exchange Subcommittee, chartered by DOD INST 4151.9 [Ref (8)], an Interactive Electronic Technical Manual Working Group, chaired by the Navy, whose primary functions were to:

a. Foster the exchange of ideas and the agreement on a single approach regarding:

(1) the acquisition of IETMs which use computer technology for innovative electronic display; and

(2) presentation of Technical Manual Information among all Department of Defense Agencies.

Ref (7) Rainey, Samuel C., Joseph J. Fuller, and Eric L. Jorgensen, "The Electronic Delivery of Automated Technical Information for Logistics Support of Navy Weapons Systems: Potential, System Description, and Status," DTRC-89/007 (Feb 1989).

Ref (8) DoD Instruction 4151.9 of 3 Jan 1989, "DoD Technical Manual Program Management."

b. Develop a set of DOD Specifications for:

   (1) The acquisition of IETM data; and

   (2) The Electronic Display Systems needed for the presentation of IETMs for the maintenance of DOD weapons, systems, and equipment.

The Working Group was also charged with the responsibility of providing a recommendation to the DOD CALS Policy Office concerning inclusion of IETM interchange Specifications into the set of CALS standards; e.g., in connection with MIL-STD-1840.

The Tri-Service Working Group consists of representatives of (a) the David Taylor Research Center (DTRC) of the Navy, (b) the Air Force Logistics Command (AFLC-MMDE), and (c) the US Army Communications-Electronics Command (AMCPM-TMDE).

With DTRC and the Air Force Human Resources Laboratory (as an advisor to AFLC) contributing the primary effort, a series of five Specifications (see Section 2.3) and Handbooks for IETM acquisition has been drafted. This series consists of:

- A Specification governing the nature of the Revisable IETM Data Base;

- A Specification providing general Content, Style, Format, and User-Interaction Requirements for all IETMs;

- A Handbook describing for a System Acquisition Manager the best approach to writing acquisition Specifications

for individual View Packages (to be used for IETM procurement);

■ A Handbook presenting requirements for the Electronic Display System;

■ A specification presenting requirements for an IETM Quality Assurance Program.

These documents have been widely circulated for comment within both the DOD and Industry.

These drafts were also developed to accomplish as a near-term objective the provision of a suite of IETM prototype acquisition documents for use by major DOD programs in establishing initial IETM capabilities. These programs include the Navy's A-12 Attack Aircraft Program, the Advanced Tactical Fighter Program of the Air Force, and the M-1 Main Battle Tank Program of the Army.

1.5 PURPOSE OF PRESENT REPORT

The purpose of the present Report is to present and to describe in detail one of these draft documents, specifically:
Draft Military Specification: **MIL-D-IETMDB**.
Revisable Data Base for Support of Interactive
Electronic Technical Manuals (IETMs). 1 June 1990.

A series of four other Reports has been prepared, each Report describing one member of the set of five acquisition documents prepared by this Working Group [Ref (9) through Ref (12)].

Section 2 of this Report provides an overall description of this suite of Acquisition Specifications and Handbooks. Section 3 summarizes the Approach and Requirements of one of the five documents; in this case, MIL-D-IETMDB. The draft version of MIL-D-IETMDB is included in this Report as Appendix A.

Ref (9)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Handbook for Preparation of View Packages in Support of Interactive Electronic Technical Manuals," DTRC Report 90/026 (Jul 1990).

Ref (10)   Rainey, Samuel C., Eric L. Jorgensen, and Joseph J. Fuller, "Proposed Draft Military Specification for Quality Assurance (QA) Program Requirements for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/024 (Jul 1990).

Ref (11)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller, "Proposed Draft Military Handbook Presenting Requirements for an Electronic Display System for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/025 (Jul 1990).

Ref (12)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller, "Proposed Draft Military Specification for General Content, Style, Format, and User-Interaction Requirements for Interactive Electronic Technical Manuals (IETMs)," DTRC Report 90/028 (Jul 1990).

2.0 ACQUISITION DOCUMENTATION FOR INTERACTIVE ELECTRONIC TECHNICAL MANUALS AND ASSOCIATED TECHNICAL INFORMATION

2.1 DEFINITIONS

2.1.1 The Interactive Electronic Technical Manual (IETM).

As defined by the Working Group, an *IETM* is a Technical Manual, prepared (authored) by a Contractor and delivered to the Government, or prepared by a Government activity, in digital form on a suitable medium, by means of an automated authoring system; designed for electronic-screen display to an end user; and possessing the following three characteristics:

a. The format and style of the presented information are optimized for screen presentation to assure maximum comprehension; that is, the presentation format is "frame-oriented", not "page-oriented".

b. The elements of Technical Information constituting the TM are so interrelated that a user's access to the *information he requires* is facilitated to the greatest extent possible, and is achievable by a variety of paths.

c. The computer-controlled TM-Display Device can function interactively (as a result of user requests and information input) in providing procedural guidance, navigational directions, and supplemental information; and also in providing assistance in carrying out logistic-support functions supplemental to maintenance.

This terminology is consistent with the standard DOD definition of *Technical Manual*. Ref (8), states:

> Technical Manuals are publications that contain instructions for the installation, operation, maintenance, training, and support of weapon systems, weapon-system components, and support equipment. TM information may be presented in any form or characteristic, including but not limited to hard printed copy, audio and visual displays, magnetic tape, discs, and other electronic devices. They normally include operational and maintenance instructions, parts lists or parts breakdowns, and related technical information or procedures exclusive of administrative procedures. Technical Orders (TOs) that meet the criteria of this definition may also be classified as TMs.

2.1.2 The View Package.

IETM information, as provided to the end user for viewing on an Electronic Display Device, will be constructed in individual task-oriented increments called View Packages.

A *View Package (VP)* is a fully organized and formatted item of computer-processible Technical Information derived from an IETM Data Base and capable of interactive electronic display to an end user by means of an Electronic Display System (EDS). In function and design, a View Package is completely equivalent to an individual Interactive Electronic Technical Manual. A View Package may be constructed:

a. entirely by an Author using an automated authoring system;

b. completely automatically using a series of automated
   processes (software) which perform the data-selection,
   structuring, and formatting processes; or

c. by a combination of the above two approaches.

A View Package is designed to support a specific function
in the operation or logistics-support of a weapon system or
other military equipment.

2.1.3   Nature and Purpose of the Revisable IETM Data Base

As noted above, a View Package is created entirely from
data contained in a *Revisable IETM Data Base* (IETMDB), which is
a complete collection of Data Elements relating to a weapon
system or other equipment acquired by the Government and
constructed in a standardized procedure in order to provide the
following capabilities:

a. Government activities or DOD Contractors concerned
   with logistic support for the weapon system involved
   can access the Data Base directly to obtain needed
   logistic-support information for specific purposes.

b. The IETMDB can serve as the basis for construction
   and update of the entire suite of electronically
   displayed interactive weapon-system Technical
   Manuals through the use of automated authoring
   systems.

c. The IETMDB can serve as the basis for fully
   automated construction, by either a Contractor or a

Government Activity, of View Packages, which are increments of interactive electronically presented logistic-support Technical Information.

d. Required portions of the IETMDB can be interchanged by means of standardized procedures throughout the DOD and its supporting Contractors on a real-time basis when needed.

2.1.4 The Electronic Display System (EDS)

The EDS is a computer-based Technical Information system designed to accept, process and integrate Technical Information for prime-equipment logistics support, and display that information to users. The EDS is also intended to support inquiries by users (in addition to Operations and Maintenance users) who have such responsibilities as supply, training, field-data collection, readiness measurement, operations scheduling, maintenance planning, maintenance quality control, and hardware configuration control. The software supporting the EDS will also be required to support additional (as yet unspecified) functions in the future, which will emerge as technologies and standards evolve. Specifically, the EDS is intended for use:

a. In maintenance Work Centers and shops to support Troubleshooting and Planned and Corrective Maintenance;

b. In portable form at remotely located maintenance sites;

c. Embedded in a weapon-system control panel as support both for System operation and System maintenance;

d. In presenting operating and maintenance information during personnel training courses;

e. In a variety of centers and offices in support of System-related, logistics-supported functions which require Technical Information.

The Electronic Display System will consist of one or more computer-controlled Devices which display the required Technical Information by means of a screen (such as a cathode-ray-tube or a plasma display) either in a pre-ordered sequence or in random-access increments, as called for by the user; e.g., a maintenance technician. To accomplish this display, the IETM, consisting of the Technical Information recorded on a suitable medium (e.g., on an optical disc), is designed to be loaded into the EDS, "read" by this Device, and displayed in a sequence as directed by the user.

The IETMs to be used by this Display System must accordingly be so constructed as to assure full compatibility with the operating software of the Display Device, and must be tested by the preparing Contractor on such a Display Device prior to delivery.

2.1.5 <u>Summary</u>

As noted, all IETMs:

a. Will be constructed through the use of an automated authoring system, and will consist of task-related increments referred to as View Packages;

b. Will be based on an automated system Data Base, the IETMDB, prepared by the System Prime Contractor for delivery as such to the Government, retention for his own use, or both;

c. Will consist of a digital data stream recorded on an optical or magnetic medium, but not paper, electronically displayed by the Electronic Display System in terms of text and graphics;

d. Will be optimally formatted and styled for screen presentation (i.e., "frame oriented" rather than "paper oriented").

e. Will be constructed for electronic display on a highly interactive Electronic Display System, which will support related logistic-support functions and which may be networked for interface with other Service Information Management Systems.

2.2   IETM PROCUREMENT OPTIONS

Logistic-support procedures for weapon systems and related equipment differ to some extent among the Services. A certain amount of necessary variation in the acquisition procedures involving the VPs, the IETMDB, and the EDS has been provided in the system of Specifications and Acquisition Handbooks developed by the IETM Working Group.

Thus, these Specifications and Handbooks detail several optional approaches in the acquisition of IETMs. These are as follows:

a. Using appropriate IETM Specifications, the Service may buy whatever directly-authored Interactive Electronic Technical Manuals are required. Although the Author (equipment Prime Contractor) will need to establish an automated equipment or weapon-system (source) Data Base, this Data Base will not be acquired by the Government, but will be maintained and used by the Contractor, both for the preparation of IETMs and for other purposes.

(1) As an option, the Government might contract for on-line access to technical portions of this Contractor-owned Data Base. In such a case, both content and accessibility aspects of the IETM Data Base would have to be constructed to standard requirements.

b. Acquisition by the Government of directly authored IETMs (fully prepared and validated by the Contractor) as well as the IETM Data Base upon which they are based. Government acquisition of the IETM Data Base may involve either of the following options:

(1) Delivery to the Government in standardized form and subsequent maintenance by the Government (with or without update information supplied on a continuing basis by the Contractor);

(2) Title acquired to the IETM Data Base by the Government, but with the Data Base retained and

maintained in the Contractor's plant. The Government to be provided with on-line access to the Data Base.

c.   Based on acquisition of the IETM Data Base, using either option b.(1) or b.(2), preparation of View Packages using either a fully automated process or one which is essentially fully automated. View Packages could be prepared either:

(1) By the Contractor [based on Data-Base acquisition option b.(1)], and delivered as such to the Government, or

(2) By the Government [based on Data-Base acquisition option b.(2)].

2.3 SUMMARY AND PURPOSE OF THE DRAFT ACQUISITION SPECIFICATIONS AND HANDBOOKS PREPARED BY THE TRI-SERVICE IETM WORKING GROUP

As noted, five draft Specifications and Handbooks have been prepared, and circulated widely for DOD and Industry comment, to provide System Acquisition Managers with the necessary contractual documentation for acquisition of Interactive Electronic Technical Manuals, the associated Data Base, and the necessary Electronic Display Systems. These statements of requirements are preliminary and will certainly be modified as experience is gained with the acquisition, management, and use of this type of Technical Information, as the technology advances, and as the Department of Defense

improves its in-house logistic-support infrastructure for support of IETMs.

The five draft Specifications and Handbooks prepared by the Inter-Service IETM Working Group (of which Appendix A of this Report is one), together with individual statements of the purpose of each document, are as follows:

2.3.1 The Revisable IETM Data Base Specification

2.3.1.1 Title

Draft MIL-D-IETMDB. *Revisable Data Base for Support of Interactive Electronic Technical Manuals (IETMs)*. 1 June 1990.

2.3.1.2 Purpose

This Specification contains the requirements for a Revisable Interactive Electronic Technical Manual Data Base (IETMDB) to be constructed by a weapon-system Contractor. This non-redundant and neutrally formatted Data Base is intended to be the single source of data for all Technical Manuals to be used in support of a given weapon system, or other equipment being acquired by the Government. This Specification may be used in two primary modes:

a. as a set of standard requirements to which the Contractor must adhere in the development and

maintenance of his internal Data Base *for subsequent* conversion to Government-deliverable form; and

b.   as a set of requirements for a Data Base that is physically delivered to the Government, or is maintained by the Contractor on behalf of the Government.

2.3.2   The IETM General Content, Style, Format, and User-Interaction Requirements Specification

2.3.2.1   Title

Draft MIL-M-GCSFUI. *Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction Requirements for.* 1 June 1990.

2.3.2.2   Purpose

This Specification contains common requirements for the Content, Style, Format, and User-Interaction features required for Interactive Electronic Technical Manuals and the operating software of the devices upon which they are viewed. These IETMs are to be delivered to the Government in digital form and must be designed for interactive display to the maintenance-technician end-user by means of a computer-controlled Electronic Display System. The range of IETMs for which general requirements are described in this Specification will cover the maintenance, diagnostic, training, system-operation, parts-information, and installation functions which are

required to achieve and maintain full operational capability of a specific weapon system or other military equipment.

2.3.3 The IETM View Package Handbook

2.3.3.1 Title

Draft MIL-HDBK-IETMVP. *Guidelines for Developing Specifications for Interactive Electronic Technical Manual (IETM) View Packages.* 1 June 1990.

2.3.3.2 Purpose

The purpose of this Handbook is to provide guidance for the preparation of individual View-Package Specifications, so that System Acquisition Managers may define View Package Requirements quickly and effectively for the numerous different specialized increments of Technical Information which will be required. A Handbook of this type has been referred to as a meta-specification: a Specification describing how to write a View Package specification which is the end-item specification for procurement of an actual IETM.

2.3.4 The IETM QA Program Requirements Specification

2.3.4.1 Title

Draft MIL-M-IETMQA. *Quality Assurance (QA) Program Requirements for Interactive Electronic Technical*

Manuals (IETMs) and Associated Technical Information.
1 June 1990.

2.3.4.2 Purpose

This Specification prescribes the requirements for a
Contractor's QA program for Interactive Electronic Technical
Manuals (IETMs) and, where procured, the associated IETM Data
Bases and supporting View Packages. The requirements herein
cover the QA process and present the plan for implementing it,
from planning through final submission of the delivered product
for acceptance; they apply as well to changes and revisions
thereto.

2.3.5 The Electronic Display System Handbook

2.3.5.1 Title

Draft MIL-HDBK-EDS (Navy). *Electronic Display System
(EDS) for Interactive Electronic Technical Manuals
(IETMs).* 1 June 1990.

2.3.5.2 Purpose

This Handbook describes the basic functional requirements
for an Electronic Display System (EDS) designed to display
Interactive Electronic Technical Manuals (IETMs).   It
establishes the minimum system requirements to be used in a
detailed Specification for competitive procurement, either for
portions of the full requirements or tailored to suit the
application, user environment, device compatibility, and
interfaces to existing computer systems.

The requirements described in this Handbook are of three types:

a. Those which describe the Electronic Display System hardware;

b. Those which describe the EDS software of the display System for system operation, IETM applications, and utility functions.

c. Those which specify the minimum performance of the several individual Display Devices which constitute the EDS.

To achieve full compatibility of the EDS with the IETMs and View Packages, the Display System Software (as well as the View Package) must also be constructed in compliance with MIL-M-GCSFUI.

Each of the three Services has its own strategies for developing Specifications and Standards for an Electronic Display System. This Handbook presents the existing Navy concepts, and is accordingly identified as a Navy-only document. Proposed concepts of the other Services which do not differ extensively from requirements described in this Handbook will be included in succeeding versions of the Handbook.

2.4 RELATIONSHIP OF MIL-D-IETMDB TO OVERALL SET OF IETM-ACQUISITION SPECIFICATIONS AND HANDBOOKS

The IETM concept requires that all Technical Information required for the IETM Technical Information increments referred

to as View Packages be extracted from among the set of Data Entities contained in a single, revisable source Data Base prepared by the equipment Prime Contractor. Custody of, and direct access to, this Data Base may or may not be acquired by the Government for its own use in preparing View Packages (and for other purposes).

In order to permit System Acquisition Managers to make greatest use of this IETM Data Base, the Specification MIL-D-IETMDB has been prepared to assure that, when contractually applied: (1) its content is complete and relevant, and (2) its accessibility and transferability characteristics are compatible with standardized DOD procedures. QA procedures described in MIL-M-IETMQA are to be applied to the IETM Data Base, and Data Entities in the IETMDB are to be accessible by the automated VP extraction routines described in MIL-HDBK-IETMVP.

3.0 SUMMARY OF MILITARY SPECIFICATION MIL-D-IETMDB
Revisable Data Base for Support of
Interactive Electronic Technical Manuals (IETMs)
1 June 1990

3.1 PURPOSE OF MIL-D-IETMDB

As noted in Section 1.3 of this Report, the IETM concept includes the provision that IETMs will be prepared from a standard comprehensive revisable source Data Base which contains all of the Technical Information required for logistic support of a given weapon system or other military equipment. This Data Base will be created and maintained by the equipment Prime Contractor. The process of creating View Packages involves extraction, structuring, formatting, and adding User-Interaction features to this Technical Information.

As procurement options, the Government may:

a. physically acquire this Data Base;

b. acquire ownership of the Data Base and leave it fully under maintenance and control of the Contractor; or

c. acquire full or partial access to the Data Base without ownership.

To permit any of these three options, it has been necessary to establish requirements concerning the content, access, and transferability features of the Data Base, so that Government

Activities can interact with it in a standardized way. MIL-D-IETMDB has been prepared to serve this purpose.

Except for the content, accessibility, and interchangeability aspects of the IETMDB, the Specification does not specify the nature or construction (format) of the Data Base. MIL-D-IETMDB includes four Appendices which provide satisfactory examples of IETM Data Bases using differing approaches to construction and to tagging.

For an equipment procurement whereby a series of View Packages is also acquired, but the IETM Data Base is not acquired, the Contractor may nevertheless find it expedient to design his Data Base in accordance with MIL-D-IETMDB in case the Government may later decide to procure it or in case automated data interchange becomes necessary among a group of activities involved with logistics aspects of the military equipment involved.

3.2 NATURE OF THE IETMDB

The IETMDB is basically a collection of Data Entities. Each of these Entities is named and described in a Data Element Dictionary (DED). A detailed example of a draft DED is given as Appendix A to MIL-D-IETMDB.

3.2.1 Data Entities

Data Entities constitute the entire technical data base and are of numerous types (all identified by the DED). For

example, a Data Entity with the standard name EQUIP identifies the equipment needed to perform a particular Task or Step. There may be many <u>instances</u> in the IETMDB of the EQUIP Data Entity, each identifying one of many types of equipment needed for specific purposes. Data Entities may be "primitive" (e.g., a single graphic or line of text) or "composite" (a linked sequence of text, graphics, or text-graphics combinations).

3.2.2 Data-Entity Attributes

As noted in Section 3.1.2 of MIL-D-IETMDB, each Data Entity is associated with one or more "Attributes", also identified in the Data Element Dictionary which describes the IETMDB. (See Section 3 of Appendix A.) An Attribute (of a Data Entity) is an item of data which represents any property or characteristic of the Data Entity considered useful. As an example: For a given instance of a piece of equipment cited under a Data Entity named EQUIP, an Attribute might be the MTBF [Mean Time Between Failures] of that piece of equipment. Such an Attribute may be called a Descriptive Attribute. Another class of Attributes consists of "Contextual Attributes", which define the context for the use of the Data Entities to which these Attributes apply (e.g., an Attribute stating that Organizational Maintenance is the context for the use of a given piece of test equipment).

3.2.3 Data Entity Relationships

The IETMDB also incorporates lists of "Relationships" which provide links among Data Entities. For example, an instance of a specific equipment under EQUIP may be linked to one or more Entities identified by the name TASK, STEP, or ALTEQUID (alternative equipment which will fulfill the same

28

function). All of these Relationships must be identified in the IETMDB Data Element Dictionary.

3.3 REQUIRED FEATURES OF THE IETMDB

MIL-D-IETMDB requires that the IETM Data Base:

a. Fulfill the functions of providing the basis (source information) for constructing View Packages, both by direct authorship and by fully automated (algorithmic) procedures.

b. Provide access to a variety of logistics-support users for a wide range of purposes (these will, in general, be specified during a procurement).

c. Be capable of straightforward revision.

d. Conform closely to the Logistic Support Analysis Record (LSAR).

e. Be Validated as a part of the Contractor's Quality Assurance Program.

f. Be supplemented by a Data Element Dictionary (which is to be available on-line to users).

g. Be put into standard form for delivery to the Government (when the acquisition option is exercised).

h. Contain clear, unambiguous System applicability statements for all Data Entities contained. (This

Requirement must be closely coördinated with the data-
base revision function.)

i. Provision of data supporting both "expert" and "novice"
levels (tracks) when this option is exercised (Section
3.3.1 of MIL-D-IETMDB).

3.4 IETM DATA BASE EXAMPLES PROVIDED BY MIL-D-IETMDB

As noted, the IETMDB may be constructed (formatted) in a
variety of ways - for example, either as an object-oriented or
as a relational Data Base - so long as they are in conformance
with the requirements of the Specification. To illustrate this
variation in permitted construction, summaries of four
approaches are appended to the Specification as follows:

APPENDIX B: Description of an IETM Data Base in IDEF1X
representation.

APPENDIX C: EXPRESS Presentation of an IETM Data Base.

APPENDIX D: A NIAM [Nijssen Information Analysis
Methodology] Representation of an IETM Data
Base.

APPENDIX E: CDM [Content Data Model] version of an IETM
Data Base, prepared as an SGML [Standard
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Definition [DTD] (an AFHRL Working Draft,
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(12)   Jorgensen, Eric L., Samuel C. Rainey, and Joseph J. Fuller,
         "Proposed Draft Military Specification for General Content, Style,
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APPENDIX A

Copy of Draft Military Specification:

MIL-D-IETMDB
Revisable Data Base for Support of
Interactive Electronic Technical Manuals (IETMs)
1 June 1990

Prior to the publication of this report the document
included as Appendix A has been officially submitted to the
DOD Defense Quality Standardization Office and the DOD CALS
Policy Office by the Office of the Chief of Naval Operations,
Code 403 - Logistics Policy (OPNAV LTR 4160 Ser 403T/OU593187
dtd 4 Jun 1990). It has also been submitted to the Pageless
Technical Manual Working Group of the Aerospace Industry
Association for Review and Comment. This document was
distributed as a review draft and is largely a DTRC product
with assistance from the Air Force as noted. This Appendix
is in the exact form that was submitted to these
organizations.

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NOTE: This review draft, dated 1 June 1990, has been prepared by DTRC/AFHRL/LRC for purposes of technical review and comment by Industry and DOD organizations. It has not been approved and is subject to modification. DO NOT USE FOR ACQUISITION PURPOSES.

MILITARY SPECIFICATION

REVISABLE DATA BASE FOR SUPPORT OF INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs)

TABLE OF CONTENTS

MILITARY SPECIFICATION

REVISABLE DATA BASE FOR SUPPORT OF
INTERACTIVE ELECTRONIC TECHNICAL MANUALS (IETMs)

1. SCOPE

This Specification contains the requirements for a Revisable Interactive Electronic Technical Manual Data Base (IETMDB) to be constructed by a weapon-system Contractor. This Data Base is intended to be an integrated source of data for all Technical Manuals to be used in support of a given system, to be delivered to the Government. This Specification may be used in two primary modes: (1) as a set of standard requirements to which the Contractor must adhere in the development and maintenance of his internal data base for subsequent conversion to Government-deliverable form; and (2) as a set of requirements for a data base that is physically delivered to the Government, or is maintained by the Contractor on behalf of the Government.

1.1 Introduction

1.1.1 Nature and Purpose of the Revisable Source Data

For complex weapon systems and other types of military equipment, adequate logistic support in all its forms requires an enormous amount of current, readily accessible, accurate, and highly detailed data, consisting of Technical Information which can be displayed electronically to an end user in both textual and graphics form.

The concept that the three Services can either acquire and maintain large-scale data bases of this type, or acquire access to such data bases, maintained continuously by a Contractor, is an integral part of the Interactive Electronic Technical Manual (IETM) concept.

A Revisable IETM Data Base (IETMDB) is a complete collection of Data Entities relating to a weapon system or other equipment acquired by the Government and constructed in a standardized procedure in order to provide the following capabilities:

A. Government activities or DOD Contractors concerned with logistic support for the weapon system involved can access the Data Base directly to obtain needed logistic-support information for specific purposes.

B. The IETMDB can serve as the basis for construction and update of the entire suite of weapon-system

electronically displayed interactive Technical Manuals through the use of automated authoring systems.

C.   The IETMDB can serve as the basis for fully automated construction, by either a Contractor or a Government Activity, of View Packages, which are increments of interactive electronically presented logistic-support Technical Information.

D.   Required portions of the IETMDB can be interchanged by means of standardized procedures throughout the DOD and its supporting Contractors on a real-time basis when needed.

1.1.2   Technical Information Procurement Options

Acquisition of Technical Information to provide operational or logistic support of military equipment may be carried out by one of several optional approaches. These are as follows:

a.   Using appropriate IETM Specifications, buy whatever directly-authored Interactive Electronic Technical Manuals are required. Although the Author (equipment Prime Contractor) shall need to establish an automated equipment or weapon-system (source) data base, this data base shall not be acquired by the Government, but shall be maintained and used by the Contractor, both for the preparation of IETMs and for other purposes.

1. As an option, the Government might contract for on-line access to technical portions of this Contractor-owned Data Base. In such a case, both content and accessibility aspects of the IETM Data Base would have to be constructed to standard requirements.

b.   Acquisition of directly authored IETMs (fully prepared and validated by the Contractor) as well as the IETM Data Base upon which they are based. Acquisition of the IETM Data Base may involve either of the following options:

1. Delivery to the Government in standardized form and subsequent maintenance by the Government (with or without update information supplied on a continuing basis by the Contractor);

2. Title acquired to the IETM Data Base by the Government, but with the Data Base retained and maintained in the Contractor's plant. The Government to be provided with on-line access to the Data Base.

c.   Based on acquisition of the IETM Data Base, using either option II.A or II.B, preparation of View Packages using either a fully automated process or one which is essentially fully automated. View Packages could be prepared either:

    A. By the Contractor (based on Data-Base acquisition option II.A), and delivered as such to the Government, or

    B. By the Government (based on Data-Base acquisition option II.B)

This Specification provides requirements for a standardized Revisable IETM Data Base which shall permit the Government to acquire Technical Information by applying contractual options I, II, and III.

1.1.3 Scope and Limitations of this Specification

This Specification is directed primarily toward four aspects of the IETMDB.

(1)   The Data Base Content (through provision of a Data-Element Dictionary; see Appendix A of this Specification).

(2)   Provisions which affect access to any part (Data Entities or Data-Entity sequences) of the IETM.

(3)   Provisions which permit construction of View Packages through fully automated processes, with the IETMDB used as the single source of Technical Information. In constructing a View Package, computer programs must:

    (a) Extract selected Data Entities from the IETMDB.
    (b) Compose these Data Entities into coherent form and organize the View Package.
    (c) Apply Format, Style, and User-Interaction Requirements to the View Package to assure comprehensible interactive display to an end user on an Electronic Display System.

(4)   Provisions which affect interchangeability of the Data Base, or portions of it, to the Government, among Government Activities, and among Government Contractors involved in logistic or manufacturing support of the system involved. This area of requirements shall require standard Data-Element Tagging. Aspects of the IETMDB not directly or indirectly affecting the above four areas are left to the discretion of the Contractor. Appendixes B through E of this Specification provide samples of four different formulations of an IETMDB, which may be used for guidance.

1.2 Revisable Format-Free Technical Information

The IETMDB shall consist of an assemblage of Data Entities, including a listing of Attributes possessed by the Data Elements; and a list of explicit Relationships providing logical links among the Data Entities. The Relationships incorporated into the Data Base by the IETMDB Author provide the basis of the technical structure of the IETMs, View Packages, and other logistic-support Technical Information which shall be extracted from it. The IETMDB shall not, however, contain Format directions in the sense of arrangement of text and graphics on a display screen for presentation to the end user.

The IETMDB itself shall, of course, require a "format" (data-base structure) but, except for the limitations imposed by the requirements outlined in Section 1.1.3, this Specification does not impose structural requirements on the actual Data Base Management System (DBMS) methodology (e.g., the Data Base may be either relational or object-oriented: see Appendixes). The Input/Output functions must conform to requirements of this Specification.

1.2.1 Data Portability

The "format-free" nature of the IETMDB is intended to provide the Government with the capability to:

a.   Acquire or access the Data in a variety of ways (IETMs, View Packages, and many other types of reports; training TI);

b.   Format and Style the Data in a variety of ways for Electronic Display Options;

Elimination of formatting requirements for the IETMDB also reduces the overall magnitude of Data-Base and Data-Interchange standardization effort, and permits use of a less complex DBMS by the Contractor which is, in turn, less expensive and easier to modify.

1.2.2 Data Maintainability

Data maintainability shall involve changes to the IETMDB of the following two kinds:

a.   Additions or eliminations of, or changes to, individual Data Entities (including Attributes);

b.   Changes to Relationships (establishment of new Relationships, elimination of old Relationships).

To accommodate either type of change, the IETMDB must be constructed so that incorporation of the change automatically updates all aspects of the Data Base affected by that change.

1.2.3 Integration Support

Since one of the functions of the IETMDB is to provide direct on-line data access to a variety of users and to a number of automated logistic-support and management-information systems throughout the Services, establishment of identifiers (key words), Data-Entity relationships, and multiple-path access routes to individual Data Entities is an important part of IETMDB design and construction.

2. APPLICABLE DOCUMENTS

The following documents of issue in effect on the date of invitation for bid or request for proposal form part of this Specification to the extent specified herein. Specification and Standard issues shall be those listed in that issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the applicable contract.

2.1 Government Documents

2.1.1 Specifications and Standards

2.1.1.1 Specifications

MIL-D-28003   Digital Representation for Communication of
                 Illustration Data: CGM Application Profile

MIL-Q-9858   Quality Program Requirements.

MIL-M-GCSFUI   Manual, Interactive Electronic Technical: General
                 Content, Style, Format, and User-Interaction Requirements
                 for

MIL-M-IETMQA   Quality Assurance (QA) Program Requirements for
                 Interactive Electronic Technical Manuals (IETMs) and
                 Associated Technical Information.

2.1.1.2 Standards

MIL-STD-1388-2B   DoD Requirements for a Logistics Support Analysis

MIL-STD-1840A Automated Interchange of Technical Information

DOD-STD-2167 Defense System Software Development

DOD-STD-2168 Defense System Software Quality Program

2.1.2 Other Government Documents

MIL-HDBK-IETMVP   Preparation of View Packages in Support of
Interactive Electronic Technical Manuals

MIL-HDBK-EDS   Electronic Display System for Interactive Electronic
Technical Manuals.

2.2 Other Documents

2.3 Order of Precedence

In the event of a conflict between the text of this Specification and
the references cited herein, the text of this Specification shall take
preference.

3.   REQUIREMENTS

3.1   General Characteristics of Revisable, Format-Free Technical Information

Technical Information contained in the IETMDB shall be in the form of Data Entities (Section 3.1.1), associated with Attributes (Section 3.1.2) and Relationships (linkages to other Data Entities, Section 3.1.3). Such Technical Information may be contained within a variety of DBMS structures, but with standardized access and output features. The Technical Information contained in an IETMDB is not associated with display Format or Style information.

3.1.1   Content of Individual Data Entities

The Data Entities contained in the IETMDB consist primarily of:

(1)   primitive Data Entities (text, graphics, tables, video sequences, prompts/dialogues, software processes);

(2)   composite Data Entities, including

(a)   composite system-information Entities,

(b)   composite descriptive-information Entities,

(c)   composite troubleshooting-information Entities (fault-information, test, outcome), and

(d)   composite parts-information Entities.

(e)   composite graphic Entities

3.1.2   Data-Entity Attributes

Data-Entities have "Attributes" which describe their content (Descriptive Attributes), or which define the context for their use (Contextual Attributes), or any other Attributes considered desirable due to the special nature of certain Data Entities.

3.1.2.1   Descriptive Attributes

Data Entities when appropriate shall be associated with the three Descriptive Attributes (name, item identification, and information type) which describe the nature of that Entity's information content. All the

Technical Information in a View Package, or other subsidiary item of TI derived from the IETMDB, shall be indexed by these three Attributes.

3.1.2.1.1 Name

The name of the Data Entity shall consist of the standard nomenclature for the Data Entity. For instance, the name might be the standard nomenclature for a weapon-system component if the Entity is a system-information Entity, or it might be a procedure title if the Entity consists of a task description.

3.1.2.1.2 Item Identification

The Item-Identification Attribute shall specify the reference designator(s) and other identifiable designator(s) of the system(s), subassemblies, or part(s) referred to by the Data Entity, based on the appropriate MIL-STD-Number.

3.1.2.1.3 Information Type

The Information-Type Attribute further specifies the type of information contained in the Data Entity. For example, an Entity consisting of a procedural task statement may have the types: adjust, align, calibrate, checkout, clean disassemble, assemble, inspect, lubricate, operate, remove, install, repair, or service. An Entity consisting of a descriptive statement may have the types: equipment description, theory of operation, how-to-use-this-Manual. A graphic Entity may have the types: locator diagram, functional block diagram, schematic, wiring diagram, flow diagram, or graph/chart.

3.1.2.2 Contextual Attributes

Data Entities shall be associated with Contextual Attributes which define the situations, or "contexts", in which the Data Entity is appropriate for use.

Contextual Attributes are applied in a manner similar to that involving Precondition Entities (see Section 3.2.7.7). The information associated with a given Data Entity is appropriate only if the context of the user's situation matches the set of Contextual Attributes. Thus, two versions of the same task may exist, with different Contextual Attributes.

The following Sections contain examples of such Attributes:

3.1.2.2.1 Security-Classification Attributes

The Security Attributes shall define the highest level of security covered by the Data Entity's contents.

3.1.2.2.2 System Configuration and Effectivity

The System-Configuration Attribute shall contain the list of the system configurations, or model numbers, to which the Data Entity applies.

3.1.2.2.3 Maintenance Level

The Maintenance-Level Attribute shall contain a list of the maintenance levels (e.g. organizational, intermediate, depot) to which the Data Entity applies.

3.1.2.2.4 Level of Detail (Track)

The Level-of-Detail Attribute (track), when more than one track is specified in the Contract, shall contain a value of "expert", "novice", or "all", which indicates the user-skill level appropriate for the Data Entity. For this purpose, "expert" and "novice" do not represent any specific military task, rank, or job qualification, but rather a relative indication of how familiar the individual is with the procedure or information being described. Information at the "novice" level of detail is written for the technician with very little recent experience with the particular maintenance task being described. Information at the "expert" level is written for the technician who frequently performs the task and does not need elementary explanations. The "expert" track shall always include all warnings, cautions, and safety-critical information which applies to the maintenance activity being described.

3.1.2.2.5 Document Version

The Document-Version Attribute shall contain a decimal number (e.g., 1.0, 1.1, 2.0) indicating the appropriate document version of the Data Entity.

3.1.2.2.6 Validation and Verification Status

The Validation-Status and Verification-Status Attributes shall indicate the Data-Entity Validation status (either validated or

unvalidated) and the Verification status (either verified or unverified), respectively.

3.1.2.2.7 Author-Defined Preconditions

In addition to the built-in Contextual Attributes described above, the Author may define additional precondition properties which must be satisfied for the Data Entity to be applicable to the current context.

3.1.2.3 Other Attributes

Individual Data Entities may have additional Attributes which define special or unique characteristics of that Data-Entity type.

3.1.3 Relationships between Individual Data Entities

Entities have relationships to other entities in the technical information database. For example: (A task entity has a list of step entities. A step entity may have a list of warning entities. A troubleshooting test entity shall have an outcome entity.) These relationships shall be explicitly identified in the database. This identification ensures that, when one part of the technical information changes, all affected information is identified. These relationships also make it easy for a presentation program to navigate through the data to find required, cross-referenced information.

3.2 Technical Information Data Entities

Data Entities of the IETMDB may be classed as primitive or composite, or in terms of the type of Technical Information contained by the Data Entity. The following Sections describe required types of Data Entities.

3.2.1 Item/System Hierarchy

The vehicle, weapon system, or other equipment that is being maintained and operated, is composed of several layers of subsystems, components, and parts. This hierarchical decomposition of the equipment being maintained and operated is accomplished by use of a system Data Entity that is used recursively, which decomposes the equipment into only those components that are being maintained or operated.

Each component of this hierarchy has associated with it at least the following five categories of information (composite elements):

    (1)   Descriptive Information
    (2)   Procedural Information
    (3)   Operational Information
    (4)   Troubleshooting Information
    (5)   Parts Information.

3.2.2 Descriptive Information

Descriptive Information provides information on system (subsystem, component, part) physical arrangement, functional behavior, theory of operation, and other aspects. Descriptive Information contains a hierarchy of narrative paragraphs. Paragraphs, in turn, may refer to primitive Data Entities. (See Section 3.2.7.)

3.2.3 Procedural Information

Procedural Information is directive, and is composed primarily of task statements. Each task Data Entity must be associated with Attributes which provide such related information as: estimated completion time; maintenance level(s) where the task is to be performed; required conditions which must be met before performing the task; and the number of people required to perform the task. A Procedural Data Element may be linked to other Data Entities which define the support equipment and consumables that task requires, through the establishment of appropriate Relationships.

3.2.4 Operational Information

Operational information contains a combination of Descriptive Information and Procedural Information, such as checklists, which is required for operating the system as a whole.

3.2.5 Troubleshooting Information

Data Entities consisting of troubleshooting information contain data necessary to isolate faults found in a system. Fault isolation is defined as identification of all defective components or parts responsible for the fault. Such data may consist of traditional fault-reporting and fault-isolation logic trees, or may provide highly interactive dynamic fault-isolation procedures. Troubleshooting information contains Fault Entities, Fault State Entities, Test Entities, Outcome Entities, and Rectification Entities.

3.2.5.1 Fault Entities

A Fault Entity may contain a variety of information providing support to the end user in performing a fault-isolation action. For example, it may:

   a.   Describe the proper performance of a component or part as contrasted with observed faulty performances;

   b.   Cite a part within a system which has been observed to contain a fault;

   c.   Cite an MTBF value expected for a system when a given part is at fault.

3.2.5.2 Fault State Entities

A Fault State Data Entity presents a fault or list of faults suspected or implicated as the result of a test that has been performed. Each suspected fault in the list may be weighted, based on the probability that it shall be the cause of the observed malfunction. The Fault State Data Entity may also present a list of possible faults that have been eliminated from consideration as the result of tests performed. Fault states may also present the next best test, based on original engineering predictions.

3.2.5.3 Test Entities

Test Entities contain list the procedural instructions a technician must follow to carry out a required task at a particular juncture in the troubleshooting procedure. Test Entities also provide all possible test outcomes.

3.2.5.4 Outcome Entities

Outcome Entities contain definitions of new fault states associated with the results of a particular test. Outcome Entities also contain a description of the state of the item being maintained. An outcome is based one or more preconditions, system states which must be established for the specific outcome to apply. The final Outcome Entity of a fault-isolation procedure shall have a Relationship which associates it with the initial Data Entity of the appropriate corrective-maintenance procedure involved in correcting the identified fault (e.g., a remove-and-replace procedure).

3.2.5.5 Rectification Entities.

Rectification entities contain references to procedural rectification tasks, checkout tests used to report the success of completed rectification tasks, and a list of all faults that the rectification shall repair.

3.2.6 Parts Information

The two types of parts information include: (1) maintenance/operation information and (2) supply information. Data Entities containing either type shall refer explicitly to corresponding Entities of the other type.

3.2.6.1 Parts Information for the Maintainer or Operator

Parts information provided for a system maintainer and/or operator shall include such items as units per assembly, usable-on code, MTBF, and reference designators.

3.2.6.2 Parts Information Provided for Parts Supply

Parts information provided for the parts-supply process must constitute unambiguous identification of a part so that it can be reordered, and must consist of such items as: the part number; Commercial And Government Entity number (CAGE); Source, Maintainability, and Reliability (SMR) code; Hardness Critical Item (HCI) code; and National Stock Number (NSN).

3.2.7 Primitive Entities

Each Data Entity containing a composite of Technical Information of the types described in Sections 3.2.1 through 3.2.6 shall cite one or more primitive Entities. Primitive Entities can be shared by (related to) more than one composite Entity. This data-base structure reduces the redundancy and volume of information which must be stored. It also improves configuration management of the data by minimizing the number of Data Entities in which changes need to be made. Eight basic types of primitive Technical Information Data Entities are described in the subsequent paragraphs.

3.2.7.1 Textual Information

Textual Information consists of alphanumeric (character) data consisting of letters, words, sentences, paragraphs, numbers, etc. Textual Information may also contain embedded references to some higher-level Data Entities such as those describing parts or consumables.

3.2.7.2 Graphics

Graphics (drawings, illustrations) information is hierarchical and object-oriented. Graphic primitives can be combined to produce composite information which can be referenced and selected. Parts information may consist of graphics. Graphics can be composed of primitive information represented in accordance with a variety of graphic standards, which must be identified (see, for example, MIL-D-28003).

3.2.7.3 Tables

Tables are represented as a series of separate entries, each entry being associated with a specific row-and-column intersection (cell) of a table. Each row and column of the table may be associated with types of information presentation and Attributes. Each entry (cell) may refer (through a Relationship) any other composite or primitive Entity in the Technical Information Data Base.

3.2.7.4 References

Cross-reference information is represented as a Data Entity which can be referenced by (related to) other composite Entities, and which itself refers to other composite or primitive Entities. A Cross-reference Entity can also refer to processes or information outside the IETMDB, such as an external diagnostic procedure or some standard reference material. A Cross-reference Entity can be associated with a type of information presentation, such as schematic reference or theory-of-operation reference.

3.2.7.5 Messages (Warnings, Cautions, Notes)

Procedural Information instructs a user to perform tasks and steps. Warnings, Cautions, and Notes which help the user perform the required task or step more effectively or more safely can be referenced. These Entities may, in turn, reference more primitive Entities, such as text.

3.2.7.6 Prompts, Assertions, Properties

Prompt Entities are required when the Author determines that specific information should be presented to the user based on some property that the user has observed. Prompt Entities contain prompting questions and associated properties which depend on the user's response. For example: " 'Is there oil on the ground?' If so, then perform Task A; otherwise,

perform Task B." These properties are represented so that a human-readable version of the property can be created, even though a machine can perform Boolean logic on the property.

Some Data Entities may have assertions which are property-value pairs to be asserted by the Display System software whenever the paragraph or step is executed by the user. Once these property values are asserted, they shall be accessible to the presentation software for later testing and processing to determine the user's context. For example, after completing a procedure to open access panel No. 111, the assertion "access panel No. 111 = open" might be stated by the system. This statement could later be used by a checkout procedure which requires that the access panel be open as a precondition for performing a test.

In Electronic Display Systems, properties can sometimes be asserted without prompting. For example, if Task A instructs the user to close a panel, the system can assert that the panel has been closed when the user completes Task A.

3.2.7.7 Precondition Entities

The Precondition Entity is similar to the Assertion Entity. An Assertion Entity tells the Display System to assert that a property is true or false; the Precondition Entity tells the Display software to test whether a property is true or false. Precondition Entities can be referenced by composite Entities. This process shall imply that the composite Entity's information is relevant only if a property is true or false. For example, a precondition that, in effect, says, "Show these steps only if the voltage on pin 5 is greater than 6 volts" may be attached to a Data Entity containing specific task statements.

3.2.7.8 Context

Context attributes work in a manner similar to precondition entities (see paragraph 3.2.7.7.). If an entity has one or more context attributes, the information associated with the entity is only appropriate if the context of the user's situation matches the set of context attributes. Two versions of the same task may exist, each with different context attributes. Depending on the context of the user's situation, the appropriate task shall be displayed. Examples of context attributes include: system configuration, security of the information, version of the information, and user-defined precondition entities.

3.2.7.9 Other Primitives

Other primitive Entities may be involved in the IETMDB. For example, Descriptive-Information and Procedural Data Entities shall have the capability to reference video processes and programmed processes as needed. A task or step Data Entity shall reference the number and type of personnel required, a list of support equipment, and a list of consumables required to complete the task or step.

3.3 Creation of the IETMDB

The IETMDB is constructed to support the generation of Interactive Electronic Technical Manuals (IETMs) through the use and creation of View Packages, and to enable the Government and its Contractors to derive a variety of technical reports for system operation and logistics support. Requirements for features (options) of the IETMDB required for these purposes shall be contained in the Contract or order, either as part of the associated IETM and View Package Specifications, or as explicit statements in the Contract Schedule.

In general, it is the acquiring activity's responsibility to develop guidelines that govern the creation of the revisable, integrated technical information database. Issues that the acquiring activity shall address to ensure the technical information and/or database it receives meets its requirements are defined in the following paragraphs.

3.3.1 Level of Detail, Multiple Tracks

The IETMDB can present task statements at both the "expert" and the "novice" levels (tracks). (See Section 3.1.2.2.4.) Which option is required (or whether both are) is a necessary input for IETMDB design. The default condition shall be presentation at the "novice" level only.

3.3.2 Data Content and Information-Presentation Type Conventions

Composite Data Entities of the IETMDB can reference (be related to) almost any other primitive or composite Entity, including Entities which identify the type of information presentation employed by the Entity. A design input for the IETMDB is the designation by the Acquiring Agency of the spectrum of information-presentation types to be required (in the IETMs, View Packages, or other reports). See, for example, MIL-M-GCSFUI and MIL-HDBK-IETMVP.

3.3.3 Numbering and Naming Conventions

Entities in the IETMDB containing information on individual components of the weapon-system hierarchy require numbers and names. The acquiring Activity shall provide suitable and consistent numbering and naming conventions for weapon systems (or other equipment).

3.3.4 Allowable Context Attributes

Certain Context Attributes may not be applicable to the IETMDB information associated with a particular system. The Acquiring Activity shall delineate, when the LSAR does not provide complete guidance, which Context Attributes apply and what values are allowable for each Context Attribute. The Acquiring Activity may also choose to limit the types of user-defined precondition Attributes.

3.3.5 Required References

The Acquiring Activity may request specific cross references to Data Entities within the IETMDB and to information sources outside the IETMDB.

3.3.6 Logistics-Support and Task-Analysis Link

The Acquiring Activity may specify the establishment of linkages (information-access capabilities) between the IETMDB and external logistics-support and task-analysis systems.

3.3.7 Text and Graphics Conventions

Data Entities in the IETMDB shall be free of Format and Style requirements. Graphics shall conform to the requirements MIL-STD-1840A.

3.4 Data Base and Data Maintenance Requirements

3.4.1 Data Base Management Summary

The Contractor shall submit to the Government a report accompanying the IETMDB which shall completely describe the processes of Data Base management and Data Base maintenance implicit in the design of the IETMDB.

3.4.2 Use of the IETMDB

The IETMDB shall serve as the single basis for the generation of system-relevant Interactive Electronic Technical Manuals and (through the use of automated processes) of View Packages. Other uses involving access by Government Activities or Government Contractors, or by

automated information systems, shall be as specified by the Acquiring Activity.

3.4.3 Data Revisability

The IETMDB shall be designed to permit simple straightforward techniques of Data Entity revision by both the Contractor and the Government. Specifically:

a. Changed Data Entities shall be revalidated as required by MIL-M-IETMQA.

b. Incorporation of any change (update) must automatically update all aspects of the Data Base affected by that change. (See Section 1.2.2.)

c. An audit trail of all changes made to any item of accessed information must be available to a user of the IETMDB.

3.4.4 File Access Requirements

Multipath on-line access shall be provided to relevant Data Entities. Such access shall at least include access paths based on any task identified in the LSAR, nomenclature of any identified item in the weapon-system or equipment hierarchy, and keyword search. Establishment of other specific access paths may be requested by the Government.

3.4.5 Configuration Management

Contextual Attributes attached to each Data Entity must make completely clear the version (model) of the weapon system or equipment to which the Data Entity applies.

A record of all IETMDB modifications made must be available to an end user as a special report observable by means of an EDS. A summary of all versions of the system supported (e.g., by individual aircraft tail numbers) must be obtainable by an end user.

Where more than one alternate edition of a Technical Information increment is supported by the IETMDB (e.g., maintenance processes for a series of aircraft systems, some of which have been modified), the different versions shall be kept completely separate. (See Section 3.2.7.6.)

3.4.6 Capability for Growth

The database shall be designed and implemented by the Contractor utilizing modular construction to allow for growth, technical advances, and extensibility. Modular design methods shall be utilized to minimize the time and effort required for adding system enhancements, interfaces, and processes.

The IETMDB must be designed so that additional Data Entities, with Associated Attributes and Relationships, can be easily incorporated into the overall data base design, and sufficient data-storage capacity and processing capability must be available to handle the data volume and growth requirements that are specified in the contract.

3.5 Preparation for Delivery to the Government

[Text for this section to be supplied later.]

4. QUALITY ASSURANCE PROVISIONS

Quality Assurance for the IETMDB preparation shall be in accordance with the requirements of MIL-M-IETMQA.

5. PACKAGING

Delivery (or other interchange) of the digital data stream constituting the IETMDB shall require that the IETMDB be put into the form specified by MIL-STD-1840A. Alternatively, the Acquiring Activity may invoke in the Contract a specification subsidiary to MIL-STD-1840A, which relates MIL-STD-1840A requirements more particularly to a Data Base of the IETMDB type as compared to product-data interchange.

6. DATA ELEMENT DICTIONARY AND DATA BASE STRUCTURE

Appendix A provides a Data Element Dictionary which lists, describes, and names the minimum set of Data Entities, with their Attributes and Relationships, required for the IETMDB. Inclusion of other Data Entities may be required by the Contract.

Although this Specification requires no specific language or data-base structure, Appendixes B through E are included as examples of satisfactory approaches to IETMDB structure based on IDEF1X (Appendix B), on EXPRESS (Appendix C), on the Nijssen Information Analysis Methodology [NIAM] (Appendix D), and on an SGML-tagged object-oriented design (Appendix E).

APPENDIXES

APPENDIX A: DRAFT DATA-ELEMENT DICTIONARY OF REVISABLE IETM DATABASE

APPENDIX B: IDEF1X REPRESENTATION OF REVISABLE IETM DATABASE

APPENDIX C: EXPRESS REPRESENTATION OF REVISABLE IETM DATABASE (to be provided by AFHRL)

APPENDIX D: NIAM REPRESENTATION OF REVISABLE IETM DATABASE (to be provided by AFHRL)

APPENDIX E: SGML REPRESENTATION OF REVISABLE IETM DATABASE

APPENDIX A

DATA ELEMENT DICTIONARY OF REVISABLE IETM DATABASE

1.0 INTRODUCTION.

The Interactive Electronic Technical Manual (IETM) data element dictionary (DED) identifies and defines all required technical information entities and attributes. The DED also defines relationships between the entities. This appendix consists of two sections. Section One contains definitions of entities and lists the relationships of each entity to other database entities. Section Two defines all identified attributes for IETM entities.

2.0 SECTION ONE: ENTITY DEFINITIONS AND RELATIONSHIPS.

Section One contains definitions of the entities which exist in Interactive Electronic Technical Manuals (IETMs). An entity is an object about which we keep information or facts. An entity may be a real, physical object, such as an employee or a machine; or it may be an abstract object, such as a schedule or event.

2.1 CONTENT.

This section contains some or all of the following entries:

    a.   Entity Name
    b.   Entity Short Descriptive Name
    c.   Entity Definition
    d.   Entity Relationships.

2.2 FORMAT.

The general format of Section One of the Data Element Dictionary is as follows:

NAME   **SHORT DESCRIPTION**

DEFINITION

  ENTITY RELATIONSHIPS

Here is an example of an entity entry:

EQUIP   Maintenance Equipment

Identifies the equipment needed to perform a particular task or step. Usually refers to a piece of test equipment, tool, or support equipment.

  Entity Relationships:
       An EQUIP is required by zero, one, or more TASKs.
       An EQUIP is required by zero, one, or more STEPs.
       An EQUIP refers to zero, one, or more ALTEQUIDs.
       An EQUIP contains one CONTEXT.

2.3 DEFINITION OF TERMS.

2.3.1 Entity Name.

The entity name is a short name used to uniquely identify the data entity.

2.3.2 Entity Short Description.

The short description ia a short noun phrase used to more clearly identify and describe the data entity.

2.3.3 Entity Definition.

The entity definition contains a narrative definition of the data element.

2.3.4 Entity Relationships.

A relationship establishes the fact that an entity is paired with another entity in some manner. These relationships are identified in this portion of the DED. All entity names are shown in capital letters.

3.0 SECTION TWO: ATTRIBUTE DEFINITIONS.

Section two contains definitions of all identified attributes of the IETM entities. An attribute of an entity is data which represents a property, or characteristic, of the entity. *To be an attribute of an entity, the* attribute must occur only once for an instance of the entity.

3.1 CONTENT.

This section contains some or all of the following entries:

        a)   Attribute Name
        b)   Attribute Descriptive Name
        c)   Data Format
        d)   Description
        e)   LSAR Reference
        f)   Attribute of: listing.

3.2 FORMAT.

The general format of Section Two of the Data Element Dictionary is as follows:

Attribute Name   **Attribute Descriptive Name**

Data Format:

Description

LSAR Reference

Attribute of: Listing

Here is an example of an attribute entry:

MTBF   **Mean Time Between Failures**

Data Format: 9(10) Right

For a particular interval, the total functional life of a population of an item divided by the total number of failures within the population during the measurement interval. The definition holds for time, rounds, miles, events, or other measure of life units.

LSAR: 204 - Mean Time Between Failures (MTBF)

Attribute of: FAULT, PARTINFO

3.3 DEFINITION OF TERMS.

3.3.1 Attribute Name.

The attribute name is a short name used to identify an attribute of an entity.

3.3.2 Attribute Descriptive Name.

The attribute descriptive name is a short noun phrase used to more clearly identify and describe the attribute.

3.3.3 Data Format.

The data format contains the format for the attribute. Most data formats consist of three fields:

    1)   Type
    2)   Length
    3)   Justification.

3.3.3.1 Type.

    A -   All characters are alphabetic.
    9 -   All characters are numeric.
    X -   Characters are any combination of alphabetic, numeric, or special characters.

3.3.3.2 Length.

The data length specifies the maximum number of characters contained in the attribute. The length, in parentheses, follows the type indicator in the data format.

3.3.3.3 Justification.

Left — Left-justified.
Right — Right-justified.
Fixed — Fixed: occupies the entire field.

3.3.3.4 Narrative.

Some attributes will indicate a data format of Narrative. Narrative indicates extended narrative data fields, capable of accepting a maximum of 65,536 characters of information.

3.3.4 Description.

A narrative definition of the attribute.

3.3.5 LSAR Reference.

Indicates an associated data item within the Logistics Support Analysis Record (LSAR). These items are found in MIL-STD-1388-2B, Appendix E.

3.3.6 Attribute of: Listing.

Identifies which entities within the revisable data base contain the current attribute.

SECTION ONE
DATA ELEMENT DICTIONARY
ENTITY DEFINITIONS

ALTEQUID   **Alternate Equipment**

The ALTEQUID identifies alternate pieces of equipment, by either Alternate Name/Alternate Equipment ID (AN/AE1D), or commercial or manufacturer designation, which may be used in substitution of a specific piece of equipment.

   Entity Relationships:
      An ALTEQUID refers to one EQUIP.
      An ALTEQUID contains one CONTEXT.

ANNOT   **User Annotation**

This entity references a comment from the technician. Annotations can be made for descriptive information or for a specific step within a procedural task.

   Entity Relationships:
      An ANNOT is referenced by zero, one, or more DESCINFOs.
      An ANNOT is referenced by zero, one, or more STEPs.
      An ANNOT refers to zero, one, or more XREFs.
      An ANNOT displays one TEXT.
      An ANNOT contains one CONTEXT.

ASSERTION   **Assertion**

An ASSERTION is a fact, defined in terms of a PROPERTY/VALUE pair, which expresses an author-defined property to be affirmed as the system processes the STEP or DESCINFO in question.

   Entity Relationships:
      An ASSERTION is asserted by zero, one, or more DESCINFOs.
      An ASSERTION is asserted by zero, one, or more STEPs.
      An ASSERTION asserts zero, one, or more PROPERTY/VALUEs.
      An ASSERTION contains one CONTEXT.

AUDIO   Audio Data

This entity references an external audio sequence which may be represented
as a file or some other external reference.

  Entity Relationships:
      An AUDIO process is invoked by zero, one, or more DESCINFOs.
      An AUDIO process is invoked by zero, one, or more STEPs.
      An AUDIO process refers to zero, one, or more XREFs.
      An AUDIO contains one CONTEXT.

CAUTION   Caution

A CAUTION is used in technical information to emphasize a procedure that,
if not strictly followed, or a condition that, if not strictly maintained,
may result in damage to the equipment.

  Entity Relationships:
      A CAUTION is presented by zero, one, or more TASKs.
      A CAUTION is presented by zero, one, or more STEPs.
      A CAUTION displays one TEXT.
      A CAUTION refers to zero, one, or more XREFs.
      A CAUTION contains one CONTEXT.

CHOICE   Choice of a Menu

This entity references one item in the list of possible selections within
a menu.

  Entity Relationships:
      A CHOICE has zero, one, or more VALUEs.
      A CHOICE is contained in one MENU.
      A CHOICE displays one TEXT.
      A CHOICE contains one CONTEXT.

CODEWORD   Codeword Designation

A CODEWORD is used when access to a specific entity is limited to a select
group of people. The context of that entity will have a codeword (i.e.
password) associated with it.

  Entity Relationships:
      A CODEWORD is contained in one CONTEXT.

COLHDDEF　　　　　**Column Heading Definition**

This entity identifies the column heading definitions portion of tabular information.

Entity Relationships:
A COLHDDEF is contained in one TABLE.

CONFIG　　　　　**Configuration**

This entity represents the configuration of the current system being maintained. This allows the system to automatically choose the correct path according to the configuration that has been entered into the system. The CONFIG is based on effectivity codes in current technical orders.

Entity Relationships:
A CONFIG is contained in one CONTEXT.

CONSUM　　　　　**Consumable Supply**

This entity identifies information about a consumable item that is required for procedural tasks or steps.

Entity Relationships:
A CONSUM is required by zero, one, or more TASKs.
A CONSUM is required by zero, one, or more STEPs.
A CONSUM refers to zero, one, or more XREFs.
A CONSUM contains one CONTEXT.

CONTEXT　　　　　**Effectivity Analysis**

CONTEXT references a set of frequently-used effectivity attributes and a list of user-defined preconditions to ensure proper traversal of database information to provide the correct information to the technician for the current system being maintained/repaired.

Entity Relationships:
A CONTEXT is contained in ALL ENTITIES.
A CONTEXT contains zero, one, or more VERSIONs.
A CONTEXT contains zero, one, or more TRACKs.
A CONTEXT contains zero, one, or more CONFIGs.
A CONTEXT contains zero, one, or more SECURITYs.
A CONTEXT contains zero, one, or more RESTRICTs.
A CONTEXT contains zero, one, or more RELEASEs.
A CONTEXT contains zero, one, or more CODEWORDs.
A CONTEXT contains zero, one, or more SCILEVELs.
A CONTEXT contains zero, one, or more DIGLYFHs.
A CONTEXT tests zero, one, or more PRECONDs.
A CONTEXT contains zero, one, or more MAINTLVLs.
A CONTEXT contains zero, one, or more VERSTATs.

DESCINFO   **Descriptive Information**

Descriptive information is used to define general-purpose, non-procedural, narrative information such as theory of operation, schematics, or wiring diagrams. DESCINFO is a flexible, general-purpose information entity. A descriptive information entity could be thought of as a piece of a textual document. These pieces could consist of a group of chapters, sections, paragraphs or individual paragraphs, sentences, etc. Each descriptive information entity points to the next descriptive information entity to be presented.

    Entity Relationships:
        A DESCINFO is referenced by zero, one, or more SYSTEMs.
        A DESCINFO is referenced by zero, one, or more OPERINFOs.
        A DESCINFO refers to zero, one, or more SUBDESCINFOs.
        A DESCINFO asserts zero, one, or more ASSERTIONs.
        A DESCINFO presents zero, one, or more TABLEs.
        A DESCINFO displays zero, one, or more GRAPHICs.
        A DESCINFO invokes zero, one, or more AUDIO processes.
        A DESCINFO invokes zero, one, or more VIDEO processes.
        A DESCINFO refers to zero, one, or more XREFs.
        A DESCINFO invokes zero, one, or more PROCESSes.
        A DESCINFO displays zero or one TEXT.
        A DESCINFO presents zero, one, or more PROMPTs.
        A DESCINFO refers to zero, one, or more ANNOTs.
        A DESCINFO contains one CONTEXT.

DIGLYPH   **Security Classification Code**

This entity represents a two-character code which relates to security classifications.

    Entity Relationships:
        A DIGLYPH is contained in one CONTEXT.

ELMNTREF   **Element Reference**

The ELMNTREF references any entity within the IETM database by the entity's reference identifier (refid).

    Entity Relationships:
        An ELMNTREF is referenced by zero, one, or more ENTRYs.
        An ELMNTREF is contained in zero, one, or more XREFs.
        An ELMNTREF refers to one OF ANY ENTITY IN THE DATABASE.
        An ELMNTREF is referenced by zero, one, or more PROPERTYs.

ENTRY   Table Entry

An ENTRY references a "cell" (a specific row and column) of a table, which
may take the form of text or any other internal entity.

   Entity Relationships:
      An ENTRY is contained in one TABLE.
      An ENTRY refers to zero or one ELMNTREFs.
      An ENTRY refers to zero or one TEXT.

EQUIP   Maintenance Equipment

This entity identifies the equipment needed to perform a particular task
or step.   EQUIP usually refers to a piece of test equipment, support
equipment, or tool.

   Entity Relationships:
      An EQUIP is required by zero, one, or more TASKs.
      An EQUIP is required by zero, one, or more STEPs.
      An EQUIP refers to zero, one, or more ALTEQUIDs.
      An EQUIP contains one CONTEXT.

EXPFAULT   Exculpated (Excluded) Fault

This entity references a list of faults that are known to be good, or
"exculpated" from blame in a particular fault state.

   Entity Relationships:
      An EXPFAULT is identified by one FLTSTATEs.
      An EXPFAULT identifies one FAULT.

FAULT   Fault Code

This entity identifies a potential failure that may occur within a system.

   Entity Relationships:
      A FAULT is identified by zero, one, or more FAULTINFs.
      A FAULT identifies one or more RECTs.
      A FAULT points to zero, one, or more PARTINFOs.
      A FAULT displays zero or one TEXT.
      A FAULT refers to zero, one, or more XREFs.
      A FAULT identifies zero, one, or more FLTSTATEs.
      A FAULT is identified by zero, one, or more EXPFAULTs.
      A FAULT is identified by zero, one, or more IMPFAULTs.
      A FAULT contains one CONTEXT.

FAULTINF   **Fault Information Data**

This entity references a collection of troubleshooting information that pertains to a given system.

   Entity Relationships:
      A FAULTINF is referenced by zero, one, or more SYSTEMs.
      A FAULTINF identifies one, or more FAULTs.
      A FAULTINF refers to zero, one, or more XREFs.
      A FAULTINF identifies one, or more TESTs.
      A FAULTINF contains one CONTEXT.

FILLIN   **Fill-In-The-Blank**

FILLIN references a fill-in-the-blank form that will be displayed to the technician. This entity is a type of system prompt; it can have a default text string for its initial entry in the fill-in-the-blank form.

   Entity Relationships:
      A FILLIN is called by zero, one, or more PROMPTs.
      A FILLIN asserts one PROPERTY.
      A FILLIN displays one TEXT.
      A FILLIN refers to zero, one, or more XREFs.
      A FILLIN contains one CONTEXT.

FLTSTATE   **Fault State**

This entity references a list of faults (i.e. an ambiguity group) that are implicated in the fault state and a list of faults that are "exculpated" from blame in the fault state. FLTSTATE provides information necessary to select the next diagnostic test, which may be done explicitly in a decision tree or by the software in a dynamic model.

   Entity Relationships:
      A FLTSTATE is identified by zero, one, or more FAULTs.
      A FLTSTATE identifies zero, one, or more EXPFAULTs.
      A FLTSTATE identifies zero, one, or more IMPFAULTs.
      A FLTSTATE displays zero or one TEXT.
      A FLTSTATE refers to zero, one, or more XREFs.
      A FLTSTATE identifies zero or one TEST.
      A FLTSTATE is identified by zero, one, or more OUTCOMEs.
      A FLTSTATE contains one CONTEXT.

FOCUS   Graphic Focus

This entity references a list of subgraphics, within a composite graphic, that are of interest in a particular illustration. This could be used to indicate applicable callout references.

    Entity Relationships:
        A FOCUS is specified by one GRAPHIC.
        A FOCUS specifies one GRPHPRIM or GRAPHIC.

FOLLOWON   Follow-On Task

This entity references a list of tasks that the technician is required to perform after completion of the current task.

    Entity Relationships:
        A FOLLOWON task is referenced by one TASK.
        A FOLLOWON task refers to one TASK.

GRAPHIC   Graphic Entity

GRAPHIC references an entity used to group graphic primitives into a composite graphic. It also supports transformations that must be performed on the graphic primitives to scale, rotate, and translate the individual primitives into a composite image.

    Entity Relationships:
        A GRAPHIC is displayed by zero, one, or more DESCINFOs.
        A GRAPHIC is displayed by zero, one, or more STEPs.
        A GRAPHIC refers to zero, one, or more SUBGRAPHICs.
        A GRAPHIC displays zero or one TEXT.
        A GRAPHIC specifies zero, one, or more FOCUS.
        A GRAPHIC contains zero, one, or more GRPHPRIMs.
        A GRAPHIC refers to zero, one, or more XREFs.
        A GRAPHIC contains one CONTEXT.

GRPHPRIM   Graphic Primitive

This entity references a single graphic component which, when combined with other primitives, can become a composite graphic. A graphic primitive references a file that contains the detailed graphic information in the form of CGM, IGES, FAX, or DXF graphic codes.

    Entity Relationships:
        A GRPHPRIM is contained in one GRAPHIC.
        A GRPHPRIM is specified by zero, one, or more FOCUS.
        A GRPHPRIM displays zero or one TEXT.
        A GRPHPRIM refers to zero, one, or more XREFs.
        A GRPHPRIM contains one CONTEXT.

IMPFAULT   Implicated Fault

This entity references a list of faults that are implicated (i.e. suspected) in a particular fault state.

  Entity Relationships:
       An IMPFAULT is identified by one FLTSTATEs.
       An IMPFAULT identifies one FAULT.

MAINTLVL   Maintenance Level

This entity represents the appropriate maintenance level of repair of an item, and helps provide the correct information for that level. Valid levels are: organizational, intermediate, and depot.

  Entity Relationships:
       A MAINTLVL is contained in one CONTEXT.

MENU   Menu of User-Selectable Choices

MENU refers to a type of prompt that is a menu with multiple choices. A menu consists of a question (i.e. text), a property, and a set of possible responses (i.e. choices). When the user chooses a response, the value associated with the selected choice is asserted for the value of the property associated with the menu.

  Entity Relationships:
       A MENU is called by zero, one, or more PROMPTs.
       A MENU asserts one PROPERTY.
       A MENU displays one TEXT.
       A MENU has one or more CHOICEs.
       A MENU refers to zero, one, or more XREFs.
       A MENU contains one CONTEXT.

NOTE   Note

This entity signifies additional information which aids the technician in completing the step or task. A note is used in technical information to emphasize an especially important procedure or condition.

  Entity Relationships:
       A NOTE is presented by zero, one, or more TASKs.
       A NOTE is presented by zero, one, or more STEPs.
       A NOTE displays one TEXT.
       A NOTE refers to zero, one, or more XREFs.
       A NOTE contains one CONTEXT.

OPERINFO   **Operational Information**

This entity references procedural task information and descriptive information required for operating the system in question.

  Entity Relationships:
      An OPERINFO is referenced by zero, one, or more SYSTEMs.
      An OPERINFO refers to zero, one, or more DESCINFOs.
      An OPERINFO refers to zero, one, or more TASKs.
      An OPERINFO refers to zero, one, or more XREFs.
      An OPERINFO contains one CONTEXT.

OUTCOME   **Test Outcome**

This entity references the fault states (both implicated and exculpated faults) known to be true following a specific test outcome.

  Entity Relationships:
      An OUTCOME is produced by zero, one, or more TESTs.
      An OUTCOME tests one or more PRECONDs.
      An OUTCOME identifies one or more FLTSTATEs.
      An OUTCOME displays zero or one TEXTs.
      An OUTCOME refers to zero, one, or more XREFs.
      An OUTCOME contains one CONTEXT.

PARTBASE   **Part Base (Supply Side)**

This entity references the information about a part that does not change, based on the place it is used on the vehicle. It represents the supply system's view of part information.

  Entity Relationships:
      A PARTBASE is identified by zero, one, or more PARTINFOs.
      A PARTBASE refers to zero, one, or more XREFs.

PARTINFO   **Part Information (Maintainer's View)**

PARTINFO references a part in terms of its reference designator, which categorizes parts by their place in the system-subsystem hierarchy. It represents the maintainer's view of part information.

  Entity Relationships:
      A PARTINFO is identified by zero, one, or more SYSTEMs.
      A PARTINFO is pointed to by zero, one, or more FAULTs.
      A PARTINFO identifies one or more PARTBASEs.
      A PARTINFO identifies one or more GRAPHICs.
      A PARTINFO refers to zero, one, or more XREFs.
      A PARTINFO contains one CONTEXT.

PERSON   **Personnel Required**

This entity references the number and type of personnel required to complete a specific step or procedure.

    Entity Relationships:
        A PERSON is required by zero, one, or more TASKs.
        A PERSON is required by zero, one, or more STEPs.
        A PERSON refers to zero, one, or more XREFs.
        A PERSON contains one CONTEXT.

PRECOND   **Precondition**

PRECOND states a property/value condition or relation that must be true for its associated data to be applicable to the current context, troubleshooting outcome, or required condition.

    Entity Relationships:
        A PRECOND is tested by zero, one, or more OUTCOMEs.
        A PRECOND tests by zero, one, or more PROPERTY/VALUEs.
        A PRECOND is tested by zero, one, or more REQCONDs.

PROCESS   **Software Process**

This entity indicates an external software process, whether it is a file, a 1553 MUX bus instruction, a software program, or some other external software process.

    Entity Relationships:
        A PROCESS is invoked by zero, one, or more DESCINFOs.
        A PROCESS is invoked by zero, one, or more STEPs.
        A PROCESS refers to zero, one, or more XREFs.
        A PROCESS contains one CONTEXT.

PROMPT   **User Input Prompt**

This entity refers to a fill-in or menu question, which the system cannot assert itself, that requires input or a decision from the user. Each prompt is associated with a property that will be asserted, along with the user's response (value), when the prompt is answered.

    Entity Relationships:
        A PROMPT is presented by zero, one, or more DESCINFOs.
        A PROMPT is presented by zero, one, or more STEPs.
        A PROMPT points to one FILLIN or one MENU.
        A PROMPT displays zero or one TEXT.
        A PROMPT refers to zero, one, or more XREFs.
        A PROMPT contains one CONTEXT.

PROPERTY   **Property**

PROPERTY references any text string that defines a conditional situation. At run time, PROPERTY/VALUE pairs may be asserted or tested by the software.

    Entity Relationships:
        A PROPERTY is asserted by zero, one, or more FILLINs.
        A PROPERTY is asserted by zero, one, or more MENUs.
        A PROPERTY has by zero, one, or more PROPERTY/VALUEs.
        A PROPERTY displays one TEXT.
        A PROPERTY refers to zero or one ELMNTREFs.

PROPERTY/VALUE   **Property-Value Pair**

This entity ties a unique property to a unique value to create a PROPERTY/VALUE pair which may be asserted or tested by the software.

    Entity Relationships:
        A PROPERTY/VALUE contains one PROPERTY.
        A PROPERTY/VALUE contains one VALUE.
        A PROPERTY/VALUE is tested by zero, one, or more PRECONDs.
        A PROPERTY/VALUE is tested by zero, one, or more ASSERTIONs.

RECT   **Fault Rectification**

RECT points to the repair procedures necessary to fix an associated fault. This entity also references tests, which are usually checkout tasks, to verify that the rectification was successful. RECT also has a fault attribute used to identify all the faults repaired by the rectification.

    Entity Relationships:
        A RECT is identified by zero, one, or more FAULTs.
        A RECT identifies one or more TASKs.
        A RECT identifies zero, one, or more TESTs.
        A RECT displays zero or one TEXT.
        A RECT refers to zero, one, or more XREFs.
        A RECT contains one CONTEXT.

RELEASE   **Release Specification**

This entity identifies the countries in which the document may be released.

    Entity Relationships:
        A RELEASE is contained in one CONTEXT.

REQCOND   **Required Condition**

This entity references a list of preliminary conditions that must be satisfied before performing a step or step sequence (task).

Entity Relationships:
    A REQCOND is tested by zero, one, or more TASKs.
    A REQCOND is tested by zero, one, or more STEPs.
    A REQCOND tests zero, one, or more PRECONDs.
    A REQCOND refers to zero, one, or more XREFs.
    A REQCOND contains one CONTEXT.

RESTRICT   **Restrictions**

This entity represents any security restrictions that might apply to an entity.

Entity Relationships:
    A RESTRICT is contained in one CONTEXT.

SCILEVEL   **Scientific Level**

This entity represents the scientific level of an entity.
Entity Relationships:
    A SCILEVEL is contained in one CONTEXT.

SECURITY   **Security Classification**

This entity represents the security level of the information.

Entity Relationships:
    A SECURITY is contained in one CONTEXT.

STEP   **Task Step**

This entity designates a procedural step within a task. A STEP can reference a number of primitive entities (see entity relationships).

   Entity Relationships:
        A STEP is contained in zero, one, or more TASKs.
        A STEP asserts zero, one, or more ASSERTIONs.
        A STEP presents zero, one, or more TABLEs.
        A STEP refers to zero, one, or more SUBSTEPs.
        A STEP displays zero, one, or more GRAPHICs.
        A STEP invokes zero, one, or more AUDIO processes.
        A STEP invokes zero, one, or more VIDEO processes.
        A STEP presents zero, one, or more PROMPTs.
        A STEP invokes zero, one, or more PROCESSes.
        A STEP refers to zero, one, or more ANNOTs.
        A STEP refers to zero, one, or more XREFs.
        A STEP presents zero, one, or more WARNINGs.
        A STEP presents zero, one, or more CAUTIONs.
        A STEP presents zero, one, or more NOTEs.
        A STEP reflects zero, one, or more VERBs.
        A STEP tests for zero, one, or more REQCONDs.
        A STEP requires zero, one, or more PERSONs.
        A STEP requires zero, one, or more EQUIPs.
        A STEP requires zero, one, or more CONSUMs.
        A STEP refers to one TEXT.
        A STEP contains one CONTEXT.

SUBDESCINFO Next Descriptive Information

SUBDESCINFO establishes a sequence for descriptive information entities. This entity ties the current descriptive information entity to the next descriptive information entity.

   Entity Relationships:
        A SUBDESCINFO is referenced by one DESCINFO.
        A SUBDESCINFO refers to one DESCINFO.

SUBGRAPHIC Next Graphic

This entity identifies the next higher view of a graphic to enable the user to do a "locate" on the graphic to find a piece of equipment on the vehicle.

   Entity Relationships:
        A SUBGRAPHIC is referenced by one GRAPHIC.
        A SUBGRAPHIC refers to one GRAPHIC.

SUBSTEP   **Next Step**

A SUBSTEP establishes a sequence for procedural steps. This entity ties the current step entity to the next step entity to be displayed.

   Entity Relationships:
      A SUBSTEP is referenced by one STEP.
      A SUBSTEP refers to one STEP.

SUBSYSTEM   *Lower Level System*

This entity establishes a sequence for vehicle/system/subsystems. A SUBSYSTEM ties the current system entity to the next system entity to be displayed.

   Entity Relationships:
      SUBSYSTEM is referenced by one SYSTEM.
      A SUBSYSTEM refers to one SYSTEM.

SYSTEM   **System**

This entity identifies a vehicle, system, subsystem, or subassembly entity in the equipment hierarchy. A SYSTEM may reference procedural task information, descriptive information, parts information, fault information, or operational information.

   Entity Relationships:
      A SYSTEM refers to zero, one, or more SUBSYSTEMs.
      A SYSTEM refers to zero, one, or more OPERINFOs.
      A SYSTEM refers to zero, one, or more DESCINFOs.
      A SYSTEM refers to zero, one, or more TASKs.
      A SYSTEM refers to zero, one, or more FAULTINFs.
      A SYSTEM identifies zero, one, or more PARTINFOs.
      A SYSTEM refers to zero, one, or more XREFs.
      A SYSTEM contains one CONTEXT.

TABLE   **Tabular Information**

This entity references the components required to construct a table or chart.

   Entity Relationships:
      A TABLE is presented by zero, one, or more DESCINFOs.
      A TABLE is presented by zero, one, or more STEPs.
      A TABLE contains one or more COLHDDEFs.
      A TABLE contains one or more ENTRYs.
      A TABLE refers to zero, one, or more XREFs.
      A TABLE contains one CONTEXT.

TASK   **Task**

A TASK is a set of directive steps which make up a specific maintenance procedure. A maintenance procedure could be a preventive or corrective maintenance task. Preventive tasks are preformed at regular intervals to ensure that the item or system will continue to operate correctly and safely (such as inspect, clean, lubricate, etc). Corrective (or unscheduled) maintenance procedures are performed when required to repair faulty items or systems that have been identified by troubleshooting procedures. A procedural task is made up of steps, and ties all text, graphics, messages, prompts, and references required to convey the step together. A TASK contains linking information necessary to link one TASK to other TASKs.

    Entity Relationships:
        A TASK is referenced by zero, one, or more SYSTEMs.
        A TASK is referenced by zero, one, or more OPERINFOs.
        A TASK required zero, one, or more PERSONs.
        A TASK required zero, one, or more EQUIPs.
        A TASK required zero, one, or more CONSUMs.
        A TASK presents zero, one, or more WARNINGs.
        A TASK presents zero, one, or more CAUTIONs.
        A TASK presents zero, one, or more NOTEs.
        A TASK refers to zero, one, or more XREFs.
        A TASK tests for zero, one, or more REQCONDs.
        A TASK contains one or more STEPs.
        A TASK refers to zero, one, or more FOLLOWON tasks.
        A TASK reflects zero, one, or more VERBs.
        A TASK is identified by zero, one, or more TESTs.
        A TASK is identified by zero, one, or more RECTs.
        A TASK contains one CONTEXT.

TEST   **Fault Isolation Test**

This entity indicates a diagnostic test that will lead to outcomes and guide the technician toward a rectification during troubleshooting.

    Entity Relationships:
        A TEST is identified by zero, one, or more FAULTINFs.
        A TEST is identified by zero, one, or more FLTSTATEs.
        A TEST identifies one or more TASKs.
        A TEST produces one or more OUTCOMEs.
        A TEST displays zero or one TEXT.
        A TEST refers to zero, one, or more XREFs.
        A TEST is identified by zero, one, or more RECTs.
        A TASK contains one CONTEXT.

TEXT   Text

The TEXT entity represents a string of parsable character data. This could
be a letter, number, word, sentence, paragraph, etc.

    Entity Relationships:
        TEXT is displayed by zero, one, or more DESCINFOs.
        TEXT is displayed by zero, one, or more STEPs.
        TEXT is displayed by zero, one, or more FAULTs.
        TEXT is displayed by zero, one, or more FLTSTATEs.
        TEXT is displayed by zero, one, or more TESTs.
        TEXT is displayed by zero, one, or more OUTCOMEs.
        TEXT is displayed by zero, one, or more RECTs.
        TEXT refers to zero, one, or more XREFs.
        TEXT is displayed by zero, one, or more GRAPHICs.
        TEXT is displayed by zero, one, or more GRPHPRIMs.
        TEXT is displayed by zero, one, or more ENTRYs.
        TEXT is displayed by zero, one, or more WARNINGs.
        TEXT is displayed by zero, one, or more CAUTIONs.
        TEXT is displayed by zero, one, or more NOTEs.
        TEXT is displayed by zero, one, or more FILLINs.
        TEXT is displayed by zero, one, or more PROPERTYs.
        TEXT is displayed by zero, one, or more MENUs.
        TEXT is displayed by zero, one, or more CHOICEs.
        TEXT is displayed by zero, one, or more PROMPTs.
        TEXT is displayed by zero, one, or more VALUEs.
        TEXT is displayed by zero, one, or more ANNOTs.
        TEXT contains one CONTEXT.

TRACK   User Track Level Designation

This entity represents the skill level (either Expert or Novice)
appropriate for the information the technician wants/requires in traversing
the data.

    Entity Relationships:
        A TRACK is contained in one CONTEXT.

VALUE   Value

A VALUE is paired with a specific PROPERTY so the PROPERTY/VALUE pair can
be referenced in a menu, fill-in-the-blank question, assertion, or
precondition.

    Entity Relationships:
        A VALUE is contained in zero, one, or more CHOICEs.
        A VALUE is contained in zero, one, or more PROPERTY/VALUEs.
        A VALUE displays one TEXT.

VERB   **Verb**

This entity signifies a common verb or action that may be performed within
a task or step (e.g., remove, replace, inspect, adjust, or align).

   Entity Relationships:
      A VERB is reflected by zero, one, or more TASKs.
      A VERB is reflected by zero, one, or more STEPs.
      A VERB refers to zero, one, or more XREFs.
      A VERB contains one CONTEXT.

VERSION   **Version Number**

This entity indicates the document version of the information to traverse
while performing maintenance operations.

   Entity Relationships:
      A VERSION is contained in one CONTEXT.

VERSTAT   **Verification Status**

This entity indicates whether or not the information has been verified.

   Entity Relationships:
      A VERSTAT is contained in one CONTEXT.

VIDEO   **Video Process**

This entity references an external video sequence, whether it is a file or
some other external component.

   Entity Relationships:
      A VIDEO process is invoked by zero, one, or more DESCINFOs.
      A VIDEO process is invoked by zero, one, or more STEPs.
      A VIDEO process refers to zero, one, or more XREFs.
      A VIDEO contains one CONTEXT.

WARNING   **Warning**

A WARNING notifies the technician that a task or step may be harmful to
himself or another human if not properly performed.

   Entity Relationships:
      A WARNING is presented by zero, one, or more TASKs.
      A WARNING is presented by zero, one, or more STEPs.
      A WARNING displays one TEXT.
      A WARNING refers to zero, one, or more XREFs.
      A WARNING contains one CONTEXT.

XREF   **Cross-Reference**

An XREF references a relational link between any two elements or an entity
with a file or database object.

   Entity Relationships:
      An XREF is referenced by zero, one, or more SYSTEMs.
      An XREF is referenced by zero, one, or more OPERINFOs.
      An XREF is referenced by zero, one, or more DESCINFOs.
      An XREF is referenced by zero, one, or more TASKs.
      An XREF is referenced by zero, one, or more STEPs.
      An XREF is referenced by zero, one, or more FAULTINFs.
      An XREF is referenced by zero, one, or more FAULTs.
      An XREF is referenced by zero, one, or more FLTSTATEs.
      An XREF is referenced by zero, one, or more TESTs.
      An XREF is referenced by zero, one, or more OUTCOMEs.
      An XREF is referenced by zero, one, or more RECTs.
      An XREF is referenced by zero, one, or more PARTBASEs.
      An XREF is referenced by zero, one, or more PARTINFOs.
      An XREF is referenced by zero, one, or more TEXTs.
      An XREF is referenced by zero, one, or more GRAPHICs.
      An XREF is referenced by zero, one, or more GRPHPRIMs.
      An XREF is referenced by zero, one, or more TABLEs.
      An XREF refers to zero or one REFERENCES OUTSIDE THE DATABASE.
      An XREF contains zero, one, or more ELMNTREFs.
      An XREF is referenced by zero, one, or more WARNINGs.
      An XREF is referenced by zero, one, or more CAUTIONs.
      An XREF is referenced by zero, one, or more NOTEs.
      An XREF is referenced by zero, one, or more FILLINs.
      An XREF is referenced by zero, one, or more MENUs.
      An XREF is referenced by zero, one, or more PROMPTs.
      An XREF is referenced by zero, one, or more REQCONDs.
      An XREF is referenced by zero, one, or more AUDIOs.
      An XREF is referenced by zero, one, or more VIDEOs.
      An XREF is referenced by zero, one, or more PROCESSes.
      An XREF is referenced by zero, one, or more EQUIPs.
      An XREF is referenced by zero, one, or more CONSUMs.
      An XREF is referenced by zero, one, or more VERBs.
      An XREF is referenced by zero, one, or more ANNOTs.
      An XREF is referenced by zero, one, or more PERSONs.

DATA ELEMENT DICTIONARY
SECTION TWO
ATTRIBUTE DEFINITIONS

ACTION   **Maintenance Fault Rectification Action**

Data Format: A(5)   Left

The ACTION describes the type of maintenance action required to rectify, or fix, a fault. The action can be a SWAP, which means it is a removal/replacement action, or it can be a MAINT action, which means it is an adjustment, alignment, or similar action.

Attribute of: RECT

AGENT   **Performer of Fault Isolation**

Data Format: A(7)   Left

This attribute designates whether a maintenance action (e.g., a test or a rectification action) is performed by a human or a machine.

Attribute of: RECT, TEST

CAGE   **Commercial and Government Entity**

Data Format: A(5)   Fixed

This attribute is a five-character code assigned by the Defense Logistics Services Center (DLSC) to the design control activity or actual manufacturer of an item contained in the Cataloguing Handbook H4/H8 series.

LSAR: 047 - Commercial and Government Entity (CAGE) Code.

Attribute of: CONSUM, EQUIP, PARTBASE

CODING   **Graphics Codes**

Data Format: X(80) Left

This attribute identifies the particular storage type of the current graphic file (e.g. IGES, CGM).

Attribute of: GRPHPRIM

COL   **Table Entry Column**

Data Format: 9(4)   Right

COL represents the specific column of a table where the current entry belongs.

Attribute of: ENTRY

COLNUM   **Column of a Table**

Data Format: 9(2)   Right

This attribute indicates the column number within the table to which the current element refers.

Attribute of: COLHDDEF

CONTEXT.ID Effectivity Analysis

Data Format: 9(15) Right

This attribute references the entity CONTEXT, which is a set of frequently-used effectivity attributes and a list of user-defined preconditions to ensure proper traversal of database information to provide the correct information to the technician for the current system being maintained/repaired.

Attribute of: ALTEQUID, ANNOT, ASSERTION, AUDIO, CAUTION, CHOICE, CODEWORD, COLHDDEF, CONFIG, CONSUM, DESCINFO, DIGLYPH, ELMNTREF, ENTRY, EQUIP, EXPFAULT, FAULT, FAULTINF, FILLIN, FLTSTATE, FOCUS, FOLLOWON, GRAPHIC, GRPHPRIM, IMPFAULT, MAINTLVL, MENU, NOTE, OPERINFO, OUTCOME, PARTINFO, PERSON, PROCESS, PROMPT, RECT, RELEASE, REQCOND, RESTRICT, SCILEVEL, SECURITY, STEP, SUBDESCINFO, SUBGRAPHIC, SUBSTEP, SUBSYSTEM, SYSTEM, TABLE, TASK, TEST, TEXT, TRACK, VERB, VERSION, VERSTAT, VIDEO, WARNING

DEFAULT   **Default Fill-in-the-Blank Response**

Data Format: A(80) Left

This attribute signifies a text string that will be used as the initial entry in the fill-in-the-blank form.

Attribute of: FILLIN

DEFAULTVAL Default Menu Choice

Data Format: A(1)   Fixed

This attribute indicates (Y or N) if a specific choice on a menu is considered to be the default selection.

Attribute of: CHOICE

ESTTIME   Estimated Time for Completion

Data Format: 9(10) Right

The ESTTIME indicates the amount of time, in minutes, required for the corresponding task/step to be completed.

Attribute of: STEP, TASK

FILE   Data File

Data Format: X(80) Left

This attribute represents the name of an external file which may contain graphic, audio, video, or software information.

Attribute of: AUDIO, GRPHPRIM, PROCESS, VIDEO

GOVSTD   Government Standard

Data Format: X(15) Left

GOVSTD signifies a document that establishes engineering and technical requirements for processes, procedures, practices, and methods that have been adopted as a standard.   It also establishes requirements for selection, application, and design criteria for materials.

Attribute of: CONSUM

HCI   Hardness Critical Item

Data Format: X(1)   Fixed

This attribute represents a code which indicates that an item could degrade system survivability in a nuclear, biological, or chemically hostile environment if hardness were not considered.

LSAR: 133 - Hardness Critical Item (HCI)

Attribute of: PARTBASE

ICC   **Item Category Code**

Data Format: X(2)   Left

ICC signifies a code which identifies a type of item, and indicates categories into which support and test equipment, spares, repair parts, etc. may be divided.

Note: ICCs of "A," "B," and "C" should not be assigned to   hardware items: these codes are reserved for grouping and selecting similar ICCs during automated data processing.

                    Peculiar Support Equipment and Tools not
                 Currently in the DOD Inventory (ICC Group A):

     Peculiar Support Equipment (Other)   7
     Peculiar Tools   8
     Peculiar Test Equipment   M
     Peculiar Handling Equipment   D
     Peculiar Automatic Test Equipment (ATE)   1

                  Common Support Equipment and Tools Currently
                     in the DOD Inventory (ICC Group B):

     Common Support Equipment (Other)   H
     Common Tools   4
     Common Test Equipment   5
     Common Handling Equipment   6
     Common Automatic Test Equipment (ATE)   2

Common Support Equipment and Tools Currently
in the DOD Inventory but not Assigned
to a Unit/Ship (ICC Group C):

Common Support Equipment (Other)	G	
Common Tools		N
Common Test Equipment	P	
Common Handling Equipment	R	
Common Automatic Test Equipment (ATE)	3	
Bulk Items	Q	
Training material not currently in the DOD inventory	S	
Training material currently in the DOD inventory	T	
End Item		W
Spare (repairable support item)	X	
Repair part (a nonrepairable consumable support item, component, assembly)	Y	
Repair Parts Kit	Z	
A repair part, component or assembly that is contained in a kit/set	9	
Tool Kit/Set		V
Program (Embedded software)	E	
Tech Manuals		F
Forms or records	J	
Electrostatic Discharge-Sensitive Item	K	
Electromagnetic-Sensitive Item	L	
Facilities	U	
System-Peculiar Spare Part	AA	
Maintenance Significant Consumable		AB
Modified Hand Tool		AC
Maintenance Assist Module	AD	

LSAR: 159 - ITEM CATEGORY CODE (ICC)

Attribute of: CONSUM, EQUIP

ID   **Identifier**

Data Format: X(15) Left

The ID designates a unique, machine-generated identifier for an element.

Attribute of: ALTEQUID, ANNOT, ASSERTION, AUDIO, CAUTION, CHOICE,
CODEWORD, COLHDDEF, CONFIG, CONSUM, CONTEXT, DESCINFO, DIGLYPH, ELMNTREF,
ENTRY, EQUIP, EXPFAULT, FAULT, FAULTINF, FILLIN, FLTSTATE, FOCUS, FOLLOWON,
GRAPHIC, GRPHPRIM, IMPFAULT, MAINTLVL, MENU, NOTE, OPERINFO, OUTCOME,
PARTBASE, PARTINFO, PERSON, PRECOND, PROCESS, PROMPT, PROPERTY,
PROPERTY/VALUE, RECT, RELEASE, REQCOND, RESTRICT, SCILEVEL, SECURITY, STEP,
SUBDESCINFO, SUBGRAPHIC, SUBSTEP, SUBSYSTEM, SYSTEM, TABLE, TASK, TEST,
TEXT, TRACK, VALUE, VERB, VERSION, VERSTAT, VIDEO, WARNING, XREF

INDXNUM   **Index Number**

Data Format: X(15) Left

This attribute represents the maintainer's view of part information. It describes an item by its reference designator ("refdes"), which categorizes parts by their place in the system-subsystem hierarchy.

Attribute of: PARTINFO

ITEMID   **Item Id**

Data Format: X(10) Left

The ITEMID represents the specific equipment item which is associated to the element it falls under. It could be a reference designator, social security number, part number, and so on, depending on which element it refers to.

Attribute of: ANNOT, AUDIO, CAUTION, COLHDDEF, CONSUM, DESCINFO, ENTRY, EQUIP, FAULT, FAULTINF, FILLIN, FLTSTATE, GRAPHIC, GRPHPRIM, MENU, MENU, NOTE, OPERINFO, OUTCOME, PARTBASE, PARTINFO, PERSON, PROCESS, PROMPT, RECT, REQCOND, STEP, SYSTEM, TABLE, TASK, TEST, VERB, VIDEO, WARNING

MFGCODE   **Manufacturer's Code.**

Data Format: X(10) Left

This attribute indicates the in-house code a manufacturer uses to represent parts.

Attribute of: CONSUM

MILSPEC   **Military Specification Number**

Data Format: X(10) Left

This attribute represents the exact specification for each item bought by the government.

Attribute of: CONSUM

MINSIZE   **Minimum Size**

Data Format: 9(10) Right

This attribute indicates the minimum size at which a graphic must be displayed to satisfy the technician's requirements. The unit of measure should represent the size of the image, in terms of minutes, of the angle formed between the user's eye and the top and bottom of the graphic (the arc which must be subtended at the eye by the graphic) to make the graphic readable to the user.

Attribute of: GRAPHIC, GRPHPRIM

MTBF   **Mean Time Between Failures**

Data Format: 9(10) Right

This attribute signifies, for a particular interval, the total functional life of a population of an item divided by the total number of failures within the population during the measurement interval. The definition holds for time, rounds, miles, events, or other measure-of-life units.

LSAR: 204 - Mean Time Between Failures (MTBF)

Attribute of: FAULT, PARTINFO

NAME   **Entity Name**

Data Format: X(80) Left

The NAME represents the textual name or title of an entity.

Attribute of: ANNOT, AUDIO, CAUTION, CODEWORD, COLHDDEF, CONFIG, CONSUM, DESCINFO, DIGLYPH, ENTRY, EQUIP, FAULT, FAULTINF, FILLIN, FLTSTATE, GRAPHIC, GRPHPRIM, MAINTLVL, MENU, NOTE, OPERINFO, OUTCOME, PARTBASE, PARTINFO, PERSON, PROCESS, PROMPT, RECT, RELEASE, REQCOND, RESTRICT, SCILEVEL, SECURITY, STEP, SYSTEM, TABLE, TASK, TEST, TRACK, VERB, VERSION, VERSTAT, VIDEO, WARNING

NOUNID   **Noun identifier**

Data Format: X(80) Left

This attribute indicates a general name of a part.

Attribute of: PARTINFO

NOUNTYPE   **Noun Type**

Data Format: X(80) Left

This attribute signifies more specific descriptors which differentiate part names.

Attribute of: PARTINFO

NSN   **National Stock Number**

Data Format: X(20) Left

The NSN is a number, assigned under the Federal Cataloguing Program and/or North Atlantic Treaty Organization (NATO) codification of equipment system to each approved item identification, which provides a unique identification of an item of supply within a specified Federal Supply Classification (FSC). The field consists of a three-character prefix, a thirteen-character National Stock Number (NSN), and a four-character suffix code. For applicable codes, see DOD 4100.38-M.

LSAR: 227 - National Stock Number and Related Data

Attribute of: CONSUM, EQUIP, PARTBASE

OP   **Operator**

Data Format: A(3)   Left

This attribute signifies the operator within a comparison between a property and a value. Some examples are: EQ (equal), LE (less than or equal), GT (greater than), NE (not equal).

Attribute of: PRECOND

OPERABILITY Operability Code

Data Format: X(1)   Fixed

The OPERABILITY is a code used to indicate the operational status and mission readiness of the item during the maintenance task. Allowable values are:

Full Mission-Capable: performance of the maintenance   C
task does not degrade any mission capability.

Partial Mission-Capable: performance of the   D
maintenance task degrades the mission capability of
the system, but can perform at least one mission.

System Inoperable During Equipment Maintenance: A
system is not available to perform all normal
operations.

System Operable During Equipment Maintenance: system   B
is available to perform normal operations.

Not Mission-Capable: system cannot perform any   E
missions.

Off-Equipment Maintenance: task is performed after G
the item under analysis has been removed from the
system.

Turnaround: task occurs during normal turnaround   F
operations, and does not affect the operability of
the system.

LSAR: 374 - Part of Task Code

Attribute of: TASK

PARTNUM   Part Number/Reference Number

Data Format: X(32) Left

PARTNUM signifies any number, other than a government activity stock number, used to identify an item of production or supply.

LSAR: 302 - Reference Number

Attribute of: PARTBASE

PENPATT   **Pen Pattern**

Data Format: X(10) Left

This attribute represents the bit-map pattern to be used as the pen for drawing lines, points, etc. for a particular graphic.

Attribute of: GRAPHIC, GRPHPRIM

PENSHAPE   **Pen Shape**

Data Format: X(10) Left

This attribute indicates the boundary shape for the pen for drawing lines, points, etc. for a particular graphic.

Attribute of: GRAPHIC, GRPHPRIM

QUANTITY   **Quantity**

Data Format: 9(10) Right

The QUANTITY signifies the amount of the appropriate consumable, equipment, or people required for the associated task/step.

Attribute of: CONSUM, EQUIP, PERSON

RANGE   **Range of Values**

Data Format: X(80) Left

This attribute represents the boundaries for valid choices or outcomes, according to the element containing the range.

Attribute of: FILLIN, TEST

REFDES   **Reference Designator**

Data Format: X(10) Left

The REFDES is an identifier assigned according to a numbering scheme for parts of a system which reflects the hierarchical assembly of the system.

Attribute of: PARTINFO

REPLVL   **Replenishment Level**

Data Format: X(10) Left

This attribute represents the minimum quantity of a part in stock that will trigger a reorder or stock action.

Attribute of: PARTINFO

ROW   **Tabular Row**

Data Format: 9(10) Right

This attribute indicates a particular row in a table.

Attribute of: ENTRY

SELECT   **Number of Selections on a Menu**

Data Format: A(1)   Fixed

This attribute represents the number of choices which may be selected from a menu element, either single (S) selection or multiple (M) selection.

Attribute of: MENU

SEQUENCE   **Entity Sequencer**

Data Format: 9(3)   Right

This attribute identifies the sequence in which particular database entities should be presented in an IETM.

Attribute of: FOLLOWON, SUBDESCINFO, SUBGRAPHIC, SUBSTEP, SUBSYSTEM

SERVICEDES   **Service Designator Code**

Data Format: X(1)   Fixed

The SERVICEDES is a single-position code identifying the military service or nonmilitary major governmental agency having jurisdiction over, or executive management responsibility for, the acquisition. Allowable values are:

Army	A
Air Force	F
Marine Corps	M
Navy	N
Coast Guard Y	
All Military	X
Federal Aviation Administration T	
FAA/All Military J	
National Security Agency	S
Other O	

LSAR: 334 - SERVICE DESIGNATOR CODE

Attribute of: TASK

SMR   **Source, Maintenance, Recovery Code**

Data Format: X(6)   Left

SMR codes are alphabetic or alphanumeric symbols used at the time of provisioning to indicate the source of supply of an item, its maintenance implications, and its recoverability characteristics. The provisioning activity may require the contractor to recommend these codes. Approved codes are defined in: AR 700-82, OPNAVINST 4410.2, AFR 66-45, MCO 4400.120, and DSAR 4100.6.

LSAR: 344 - SOURCE, MAINTENANCE AND RECOVERABILITY CODE (SMR)

Attribute of: PARTBASE

START   **Starting Point in a Graphics File**

Data Format: X(15) Left

This attribute identifies a location within a graphic file where the presentation system should start reading graphic codes for the specific graphic being presented.

Attribute of: GRPHPRIM

STOP   **Stopping Point in a Graphics File**

Data Format: X(15) Left

This attribute specifies a location within a graphic file where the presentation system should stop reading graphic codes for the specific graphic being presented.

Attribute of: GRPHPRIM

TEXT   **Textual Information**

Data Format: Narrative

The TEXT attribute indicates a text string of parsable character data. This could consist of numbers, words, sentences, paragraphs, etc.

Attribute of: TEXT

TEXT.ID   **Text Entity Identifier**

Data Format: X(15) Left

This attribute identifies a specific text string (entity) that is applicable to the current entity.

Attribute of: ANNOT, CAUTION, CHOICE, MENU, NOTE, PROPERTY, STEP, VALUE, WARNING

TITLE   **Text Title**

Data Format: Narrative

The TITLE represents parsable character data which may be used to title text or descriptive information.

Attribute of: DESCINFO, TEXT

TRANSFRM   **Transformation Matrix**

Data Format: 9(9)   Right

This attribute signifies a transformation matrix which specifies coordinate translations, scaling, or reflection and rotations in terms of homogenous coordinates.

Attribute of: GRAPHIC, GRPHPRIM

TYPE   **Entity Type**

Data Format: X(80) Left

The TYPE attribute represents a unique quality about an element. The appropriate values for each entity shall be determined by the procuring agency.

Attribute of: ANNOT, AUDIO, CAUTION, CODEWORD, COLHDDEF, CONFIG, CONSUM, DESCINFO, DIGLYPH, ENTRY, EQUIP, EXPFAULT, FAULT, FAULTINF, FILLIN, FILLIN, FILLIN, FLTSTATE, FOLLOWON, GRAPHIC, GRPHPRIM, IMPFAULT, MAINTLVL, MENU, NOTE, OPERINFO, OUTCOME, PARTBASE, PARTINFO, PERSON, PROCESS, PROMPT, RECT, RELEASE, REQCOND, RESTRICT, SCILEVEL, SECURITY, STEP, SYSTEM, TABLE, TASK, TEST, TRACK, VERB, VERSION, VERSTAT, VIDEO, WARNING

UNITMEASURE Unit of Measure

Data Format: X(15) Left

This attribute identifies the type of unit measurement used to quantify the number of consumables needed for the current application.

Attribute of: CONSUM

UNITSPER   **Units per Assembly, System, etc.**

Data Format: X(10) Left

This attribute Represents the number of units required per assembly of a system or component.

Attribute of: PARTINFO

USABLON   **Usable-On Code**

Data Format: X(10) Left

This attribute identifies the different configurations in which a part or assembly may appear within a system or vehicle.

Attribute of: PARTINFO

USER   **User Identifier**

Data Format: X(10) Left

USER represents a user identification attribute for annotations added by the user to the data.

Attribute of: ANNOT

WEIGHT   **Fault Probability**

Data Format: 9(10) Right

This attribute represents a probability associated with a given fault within a list of faults in a fault state.

Attribute of: FLTSTATE

WINDOW   **Graphic Window**

Data Format: 9(20) Right

The WINDOW attribute indicates the subrectangle within a graphic which should be displayed in those cases where the author wishes to display only a portion of a large graphic to the user.

Attribute of: GRAPHIC, GRPHPRIM

WRA OR LRU Weapon Replaceable Assembly
                 Line Replaceable Unit

Data Format: X(1)   Fixed

This attribute signifies an essential support item that is removed and replaced at field level to restore the end item to its operationally ready condition. Conversely, a non-WRA is a part, component, or assembly used in the repair of a WRA when the WRA has failed and has been removed from the end item for repair. Allowable values are:

    Item is a WRA/LRU   Y
    Item is not a WRA/LRU   N

Attribute of: PARTINFO

XREFID   **External Reference Identifier**

Data Format: X(80) Left

The XREFID identifies a reference that is not contained in the database.

Attribute of: XREF

APPENDIX B

IDEF1x REPRESENTATION OF REVISABLE IETM DATABASE

1.0 INTRODUCTION.

Appendix B contains an IDEF1x representation of revisable, format-free technical information. IDEF1x is a formal data modeling methodology consisting primarily of graphic representations. This appendix identifies the entities (see paragraph 2.1) and attributes (see paragraph 2.3) that exist in technical information, and depicts the relationships these entities have with one another. This design is not intended to represent a physical database implementation.

2.0 BASIC COMPONENTS OF IDEF1x.

The basic components of the IDEF1x design methodology are explained in the subsequent paragraphs. Figure 2.0 contains a graphic representation of the information.

2.1 ENTITIES.

An entity is an object about which information or facts are kept. An entity may be a real, physical object, such as an employee or a machine; or it may be an abstract object, such as a schedule or event. Entities are represented as boxes on IDEF1x charts. The name of the entity is shown above the box. Section One of Appendix A of the Data Element Dictionary contains a definition for each entity in the model.

2.1.1 Parent Entities.

A parent entity is an entity that does not depend upon any other entity for its existence. A parent entity may have one or more child entities (see 2.1.2). A parent entity is represented in IDEF1x as a square-cornered box.

2.1.2 Child Entities.

A child entity is dependent for its existence upon its parent. When the child has more than one parent, its existence is dependent upon all of its parents; that is, no instance of the child entity may occur without a related instance of each of its parents. A child entity is represented in IDEF1x as a rounded box.

2.2 RELATIONSHIPS BETWEEN ENTITIES.

A relationship establishes the fact that an entity is paired with another entity in some manner. Relationships are indicated by lines and dots between entities.

2.2.1 Cardinality of Relationships.

In a refined IDEF1x model (see paragraph 3.1), most relationships between entities are of the type one entity to zero, one, or many entities. This is shown as a line connected to the entity that occurs once, with a dot on the end of the line next to the entity that occurs zero, one, or many times. A letter or number next to the dot gives more specific information about the cardinality, as follows:

Z - Zero or One
P - One or Many
n - A Specific Quantity (n).

2.2.2 Relationship Labels.

Each relationship line in IDEF1x is labeled with text describing the relationship between the two entities. Relationships between entities are read from the parent entity toward the child entity.

2.2.3 Dependent Relationships.

When one child entity depends upon the existence of the parent entity, the relationship line between the two is displayed as a solid line.

2.2.4 Non-Dependent Relationships.

When two entities are related but do not depend upon the existence of each other, the relationship is displayed as a dashed line.

2.2.5 Discriminators.

When multiple entities have common attributes, a relationship between a generalization entity and its subentities is created. Generalization entities contain common attributes. Subentities branch off the generalization entity, based upon the value of a discriminator. A discriminator is an attribute of the generalization entity. For example, a PROMPT may be a MENU or it may be a textual FILLIN; the determination is made based upon the value of the TYPE attribute. A discriminator is represented as an open circle on the relationship line. Keys (see paragraph 2.3.1) of the subentities are exactly the same as the keys of the generalization entity.

2.3   ATTRIBUTES.

An attribute of an entity is data that represents a property or characteristic of the entity. An attribute of an entity must occur only once for an instance of the entity, and must always apply to an instance of an entity. If an attribute value is not always applicable or not always known, then it is not an attribute. Rather, it is a separate entity, with a relationship cardinality of "Z" (zero or one). Section Two of Appendix A of the Data Element Dictionary contains definitions for each of the attributes in the model.

2.3.1 Key Attributes.

A key attribute is an attribute or group of attributes that uniquely identify one particular occurrence on an entity. Attributes above the line in the entity box form the entity key.

2.3.2 **Foreign Keys.**

The keys of each parent entity migrate through the relationship to each child entity. The key may migrate to the child either as part of the key of the child or as a non-key attribute of the child, depending upon whether or not the key of the parent is required to uniquely identify an instance of the child. The migrated key is identified as a "foreign key" in the child by putting (FK) at the end of the attribute.

2.3.3 **Non-Key Attributes.**

Each non-key attribute has exactly one value for each instance of the entity. Different instances of the entity may have identical values for non-key attributes. Non-key attributes are listed below the line in the entity box.

3.0   **NON-IDEF1x FEATURES OF APPENDIX B.**

3.1   **UNREFINED IDEF1x MODEL.**

This appendix contains an unrefined IDEF1x model. A refined version of IDEF1x would eliminate all "many-to-many" relationships between entities. (An example of a "many-to-many" relationship is "Many different procedural STEPs could display many different WARNINGs.") To refine these relationships, new entities (intersection entities) would have to be introduced to the model. An intersection entity would be a child entity of the two entities that had the "many-to-many" relationship between them. This intersection entity would inherit the keys of each of its parents. The refining of an IDEF1x model is a physical database implementation issue, which will not be addressed in this appendix. Therefore, "many-to-many" relationships are present in this appendix.

3.2   **ENTITY CHART NUMBERS.**

All entities that occur on more than one chart have a list of applicable chart numbers under the element. The circled number indicates the chart that gives the most complete description of the entity. Chart numbers for each entity are provided with the entity definitions in Part One of Appendix A of the Data Element Dictionary.

IDEF1x METHODOLOGY
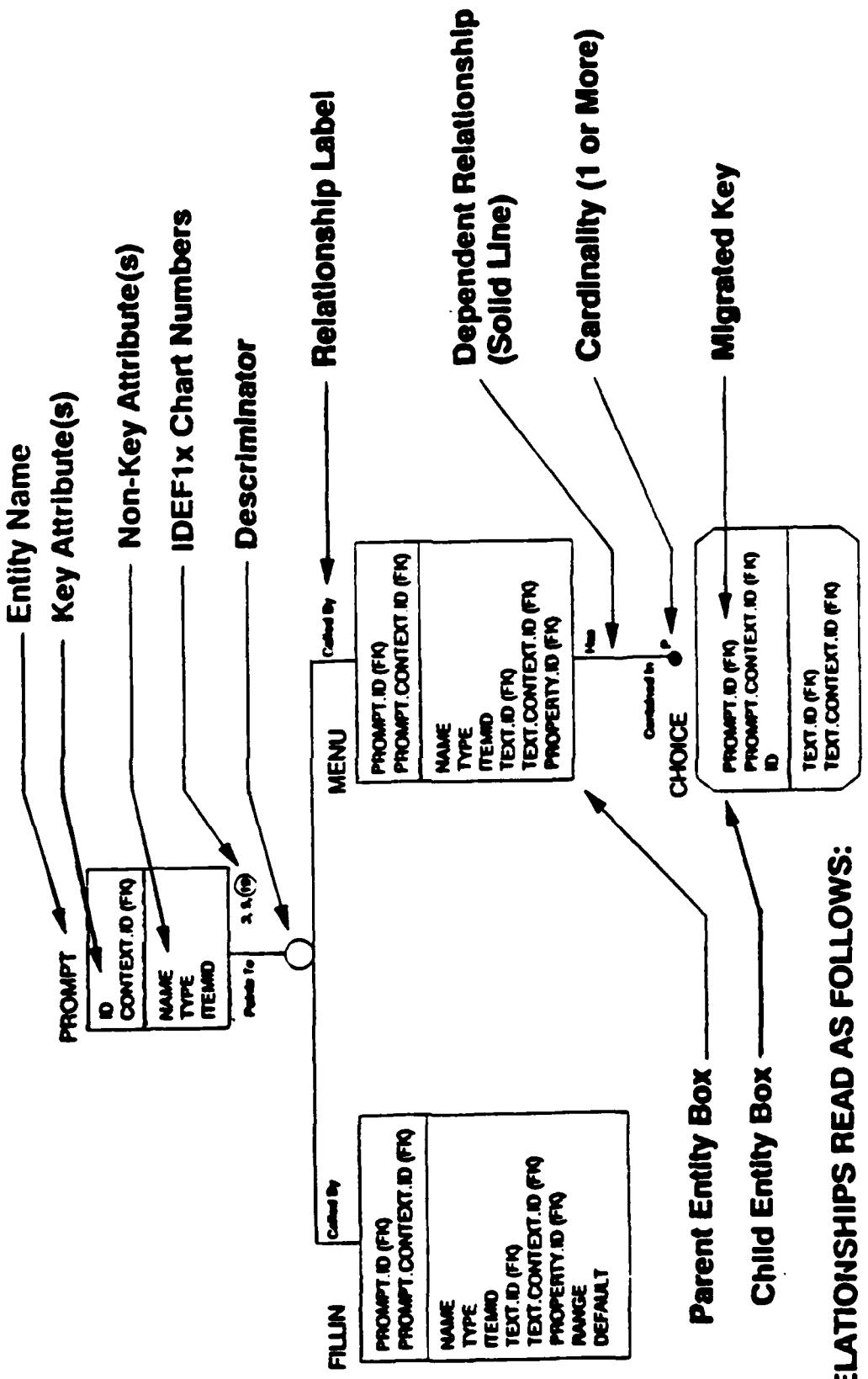
FIGURE 2.0

RELATIONSHIPS READ AS FOLLOWS:

A PROMPT points to one FILLIN or one MENU
A FILLIN is called by a PROMPT
A MENU is called by a PROMPT
A MENU has one or more CHOICEs
A CHOICE is contained in one MENU

B-4

XREF
- ID
- XREFID (FK)

ALL ⑰

PARTINFO
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID
- PARTBASE.ID (FK)
- REFDES
- MOUND
- MOUNTYPE
- UNITOPER
- INDGNUM
- USABLION
- MTBF
- REPLVL
- WRA or LRU

1, 4 ⑤

FAULTINF
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID

⑦

SYSTEM
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID

TASK
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID
- ESTTIME
- OPERABILITY
- SERVICEDES

1, ? (4) 10, 12

DESCINFO
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID
- TITLE

1, ②

OPERINFO
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID

⑩

SUBSYSTEM
- SYSTEM.ID (FK)
- SYSTEM.CONTEXT.ID (FK)
- ID
- CONTEXT.ID (FK)
- SEQUENCE

B–5

OPERATIONAL INFORMATION
CHART 2
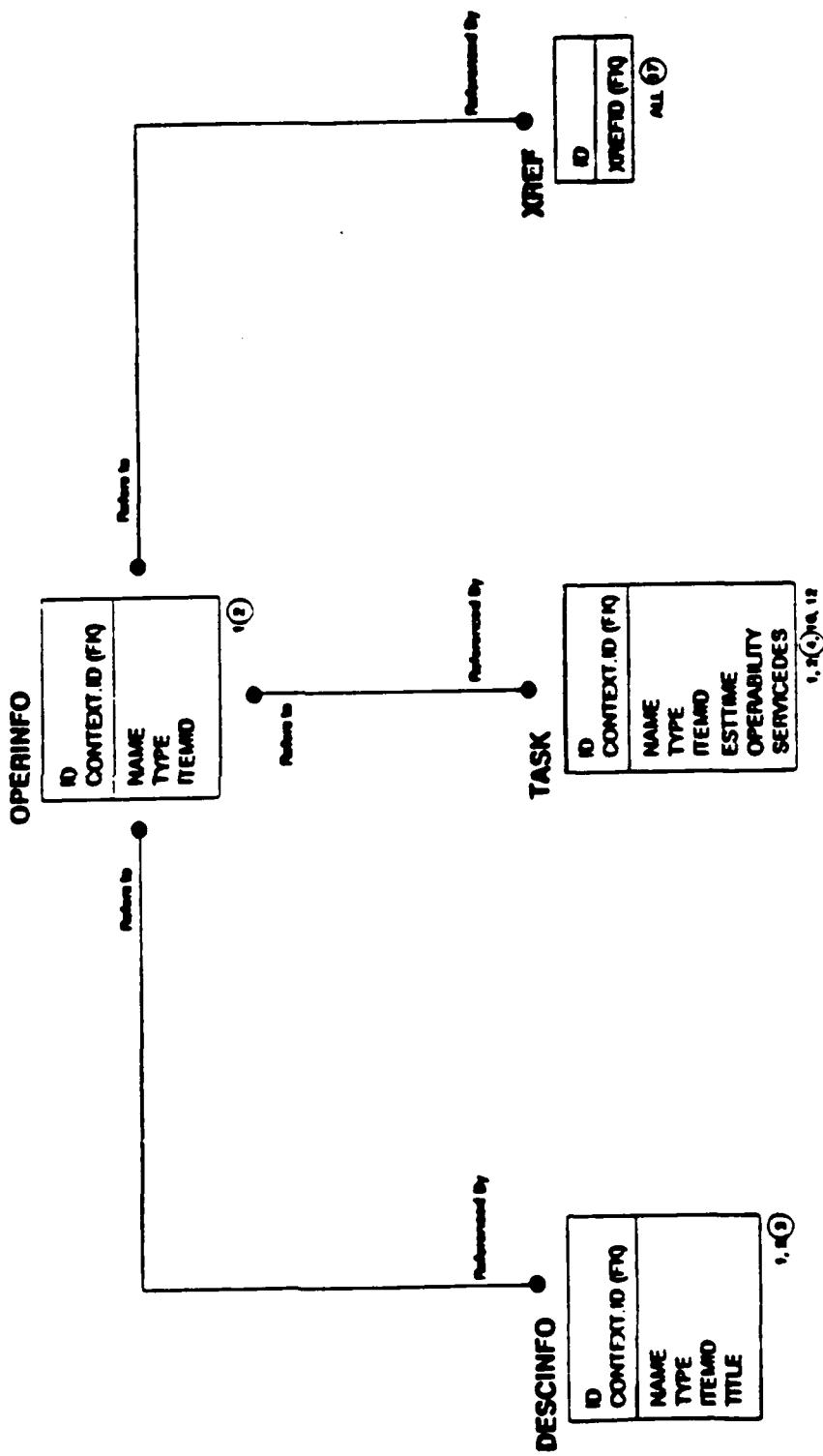
DESCRIPTIVE INFORMATION
CHART 3
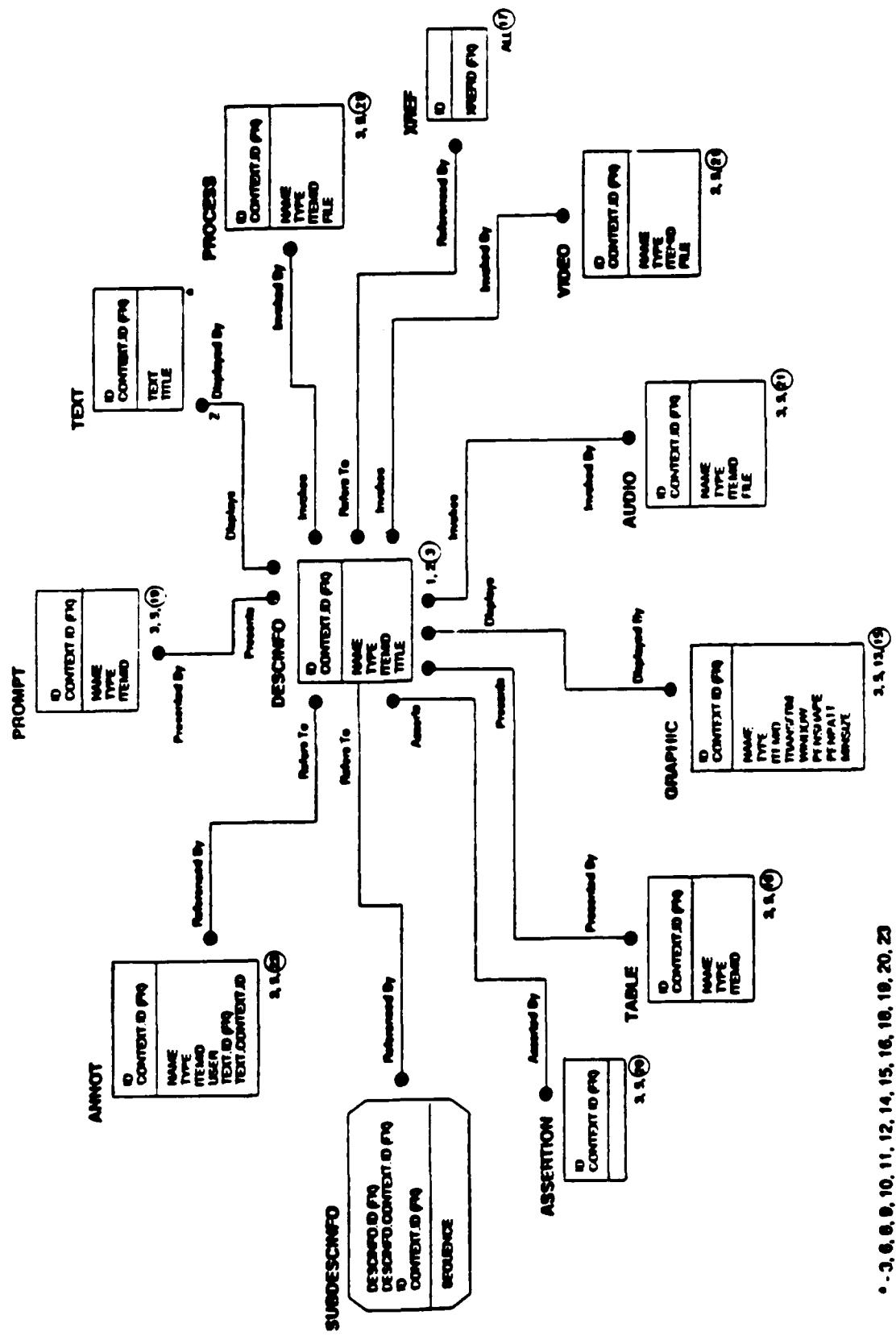
TASK STRUCTURE
CHART 4
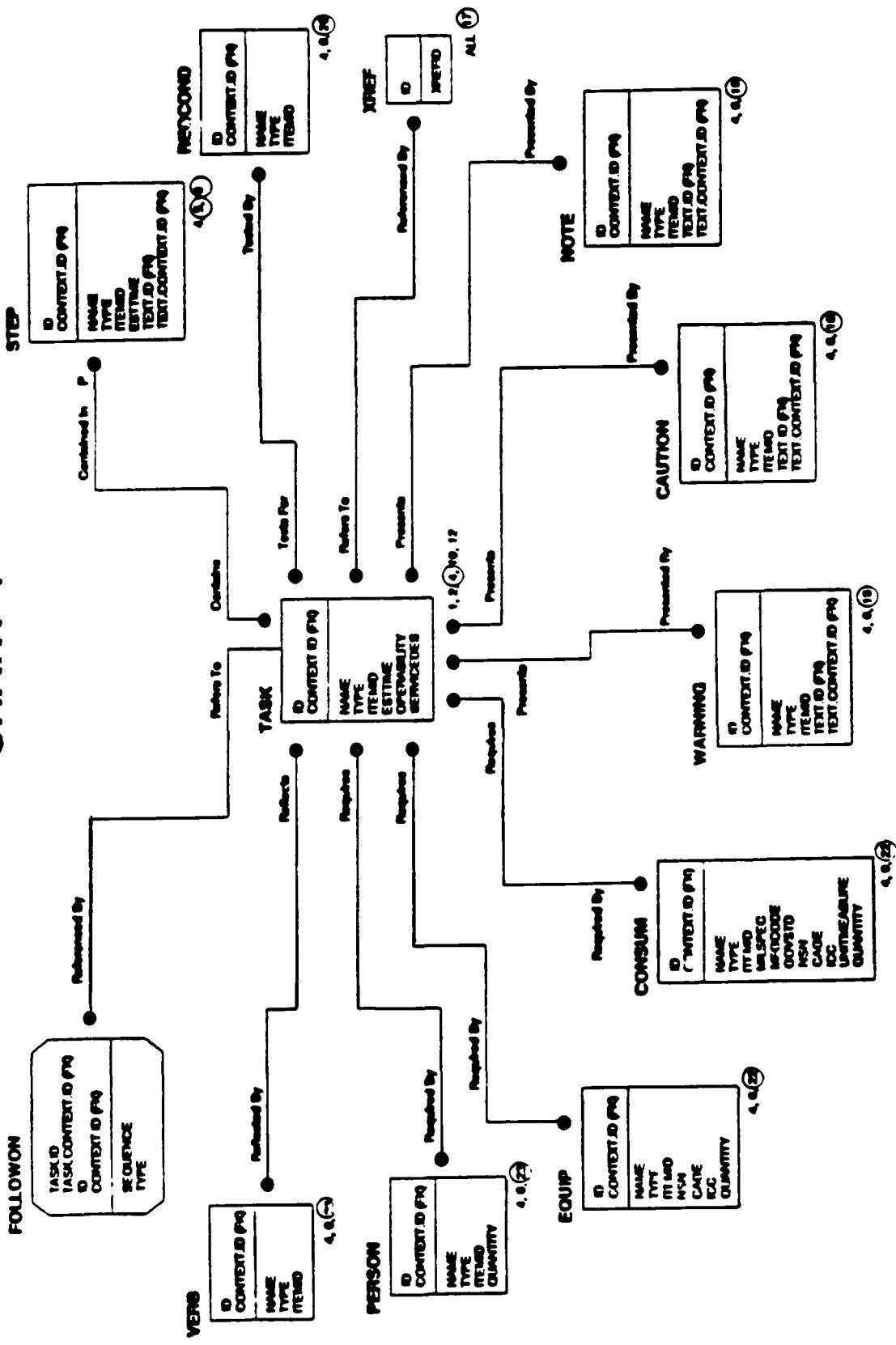
PROCEDURAL INFORMATION CONTINUED
PAGE ONE OF STEP STRUCTURE
CHART 5
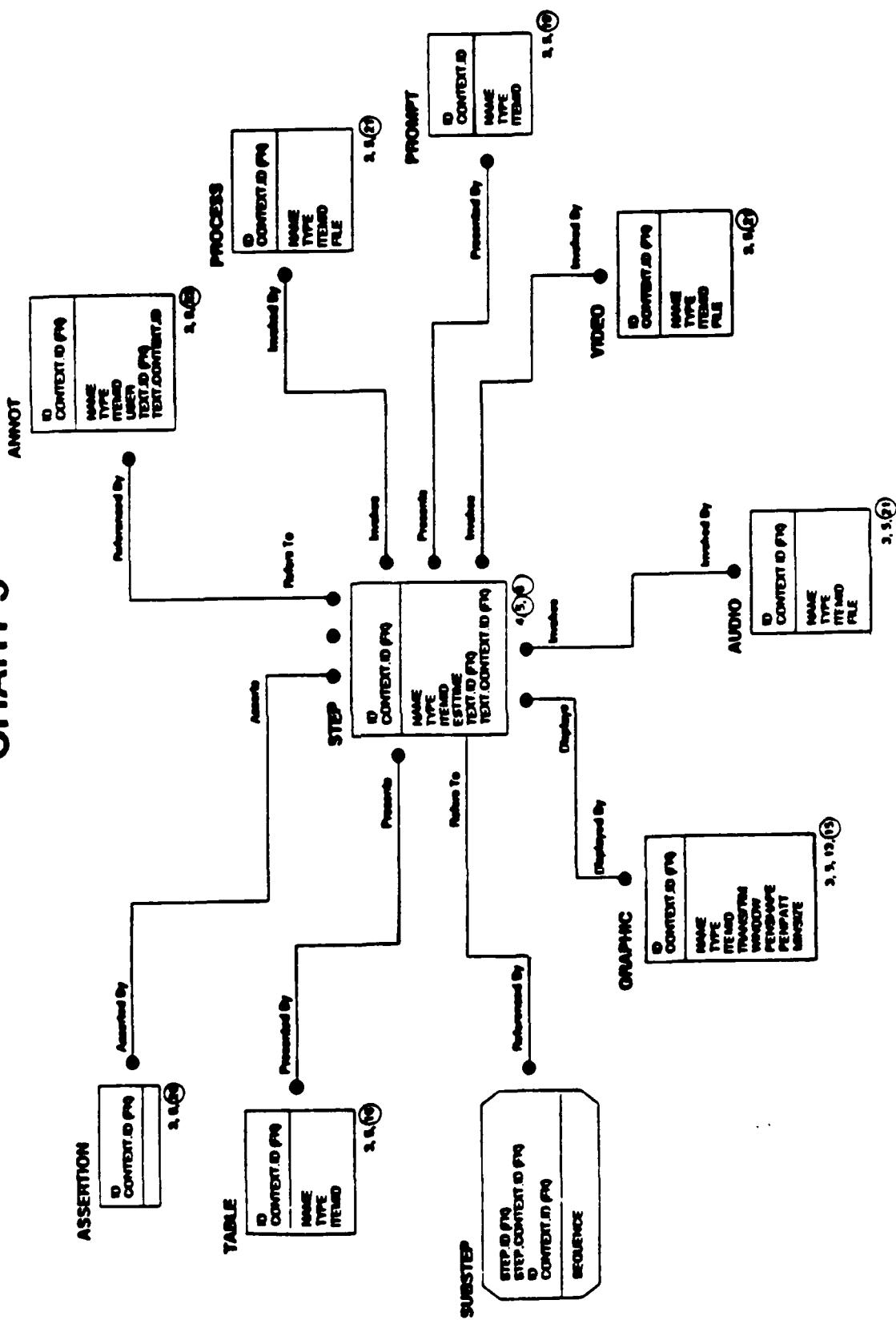
PAGE TWO OF STEP STRUCTURE
CHART 6
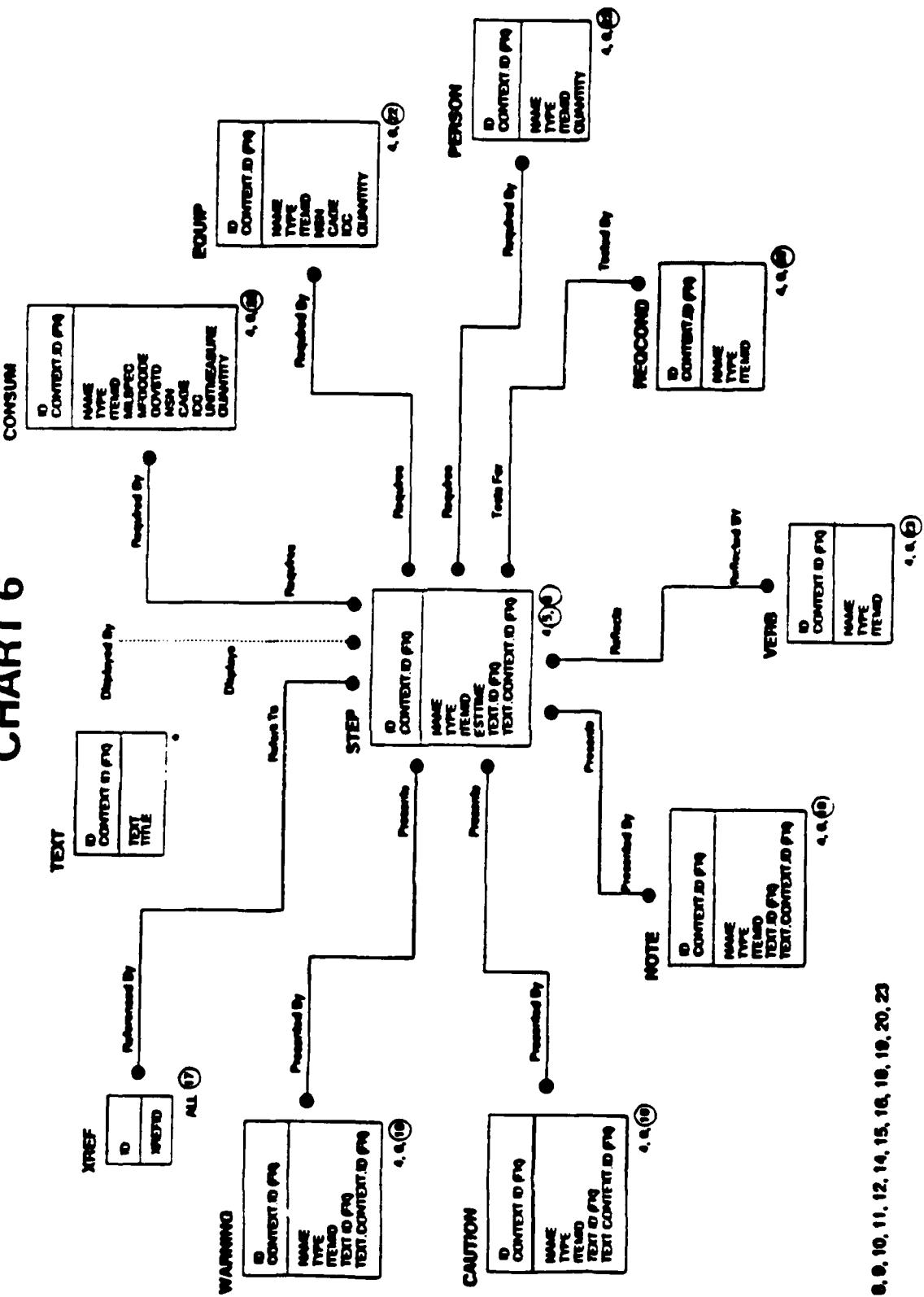
PAGE ONE OF TROUBLESHOOTING INFORMATION

CHART 7
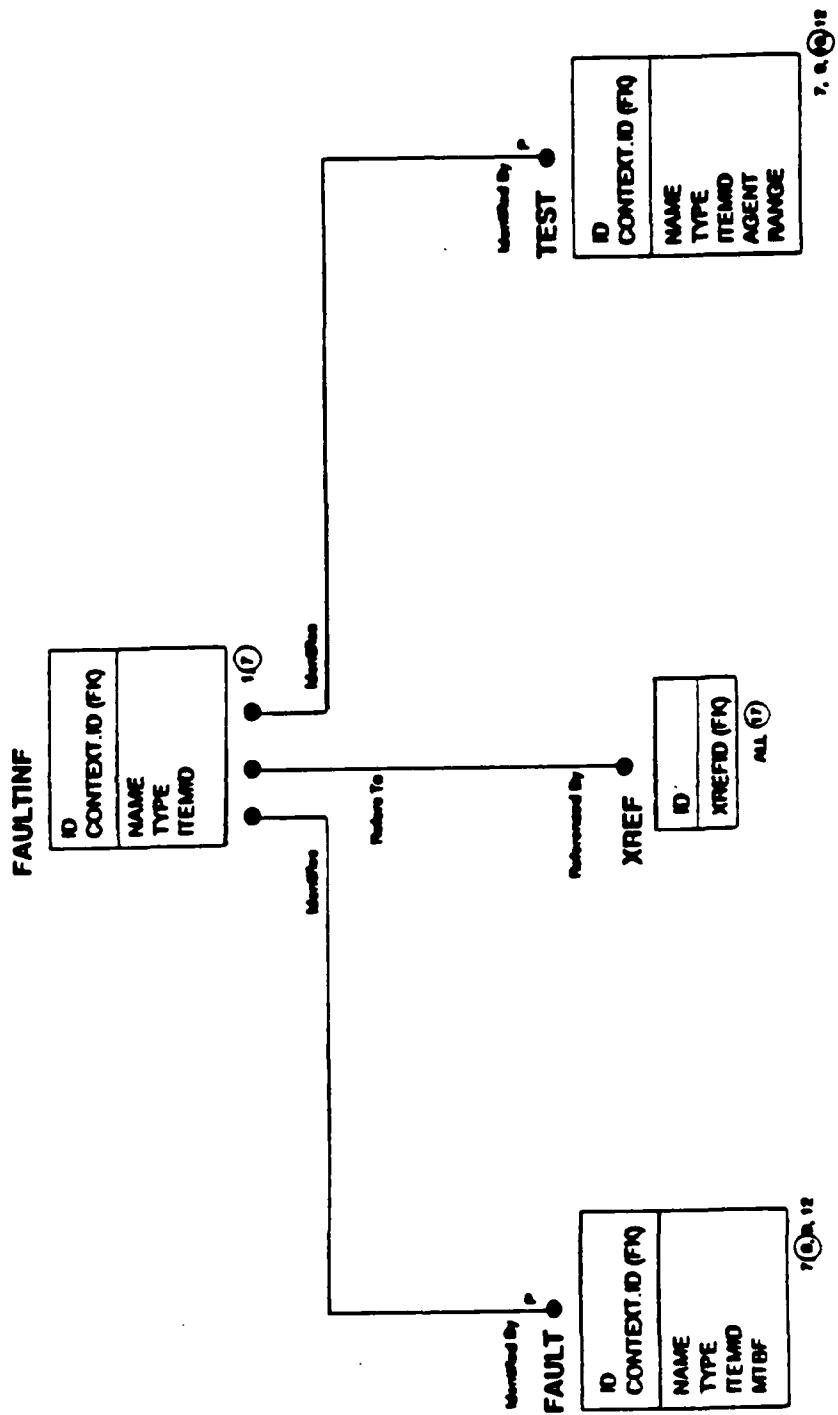
FAULTINF

ID
CONTEXT.ID (FK)
NAME
TYPE
ITEMID

TEST

ID
CONTEXT.ID (FK)
NAME
TYPE
ITEMID
AGENT
RANGE

XREF

ID
XREFID (FK)

FAULT

ID
CONTEXT.ID (FK)
NAME
TYPE
ITEMID
MTBF
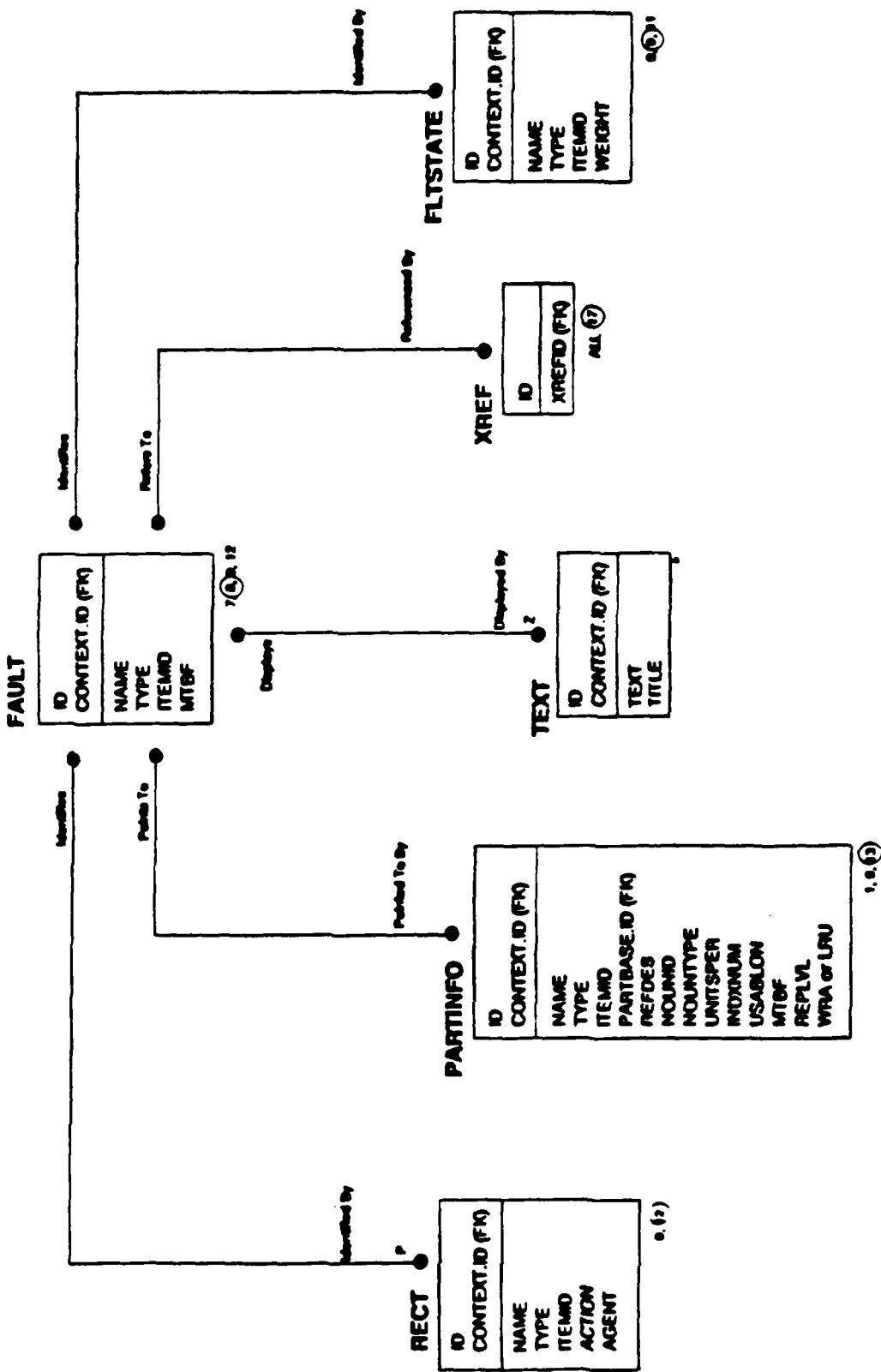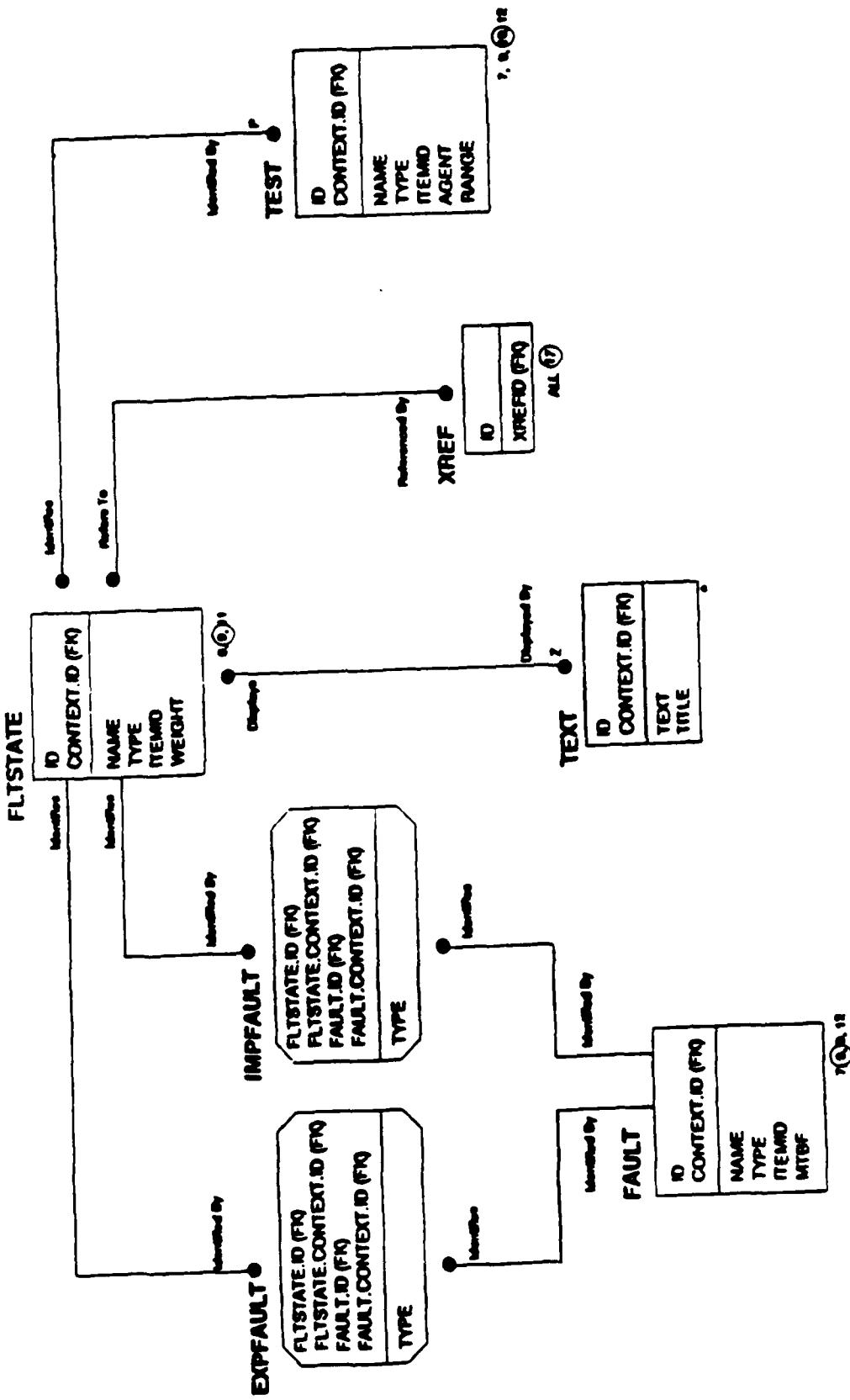
PAGE FOUR OF TROUBLESHOOTING INFORMATION
CHART 10
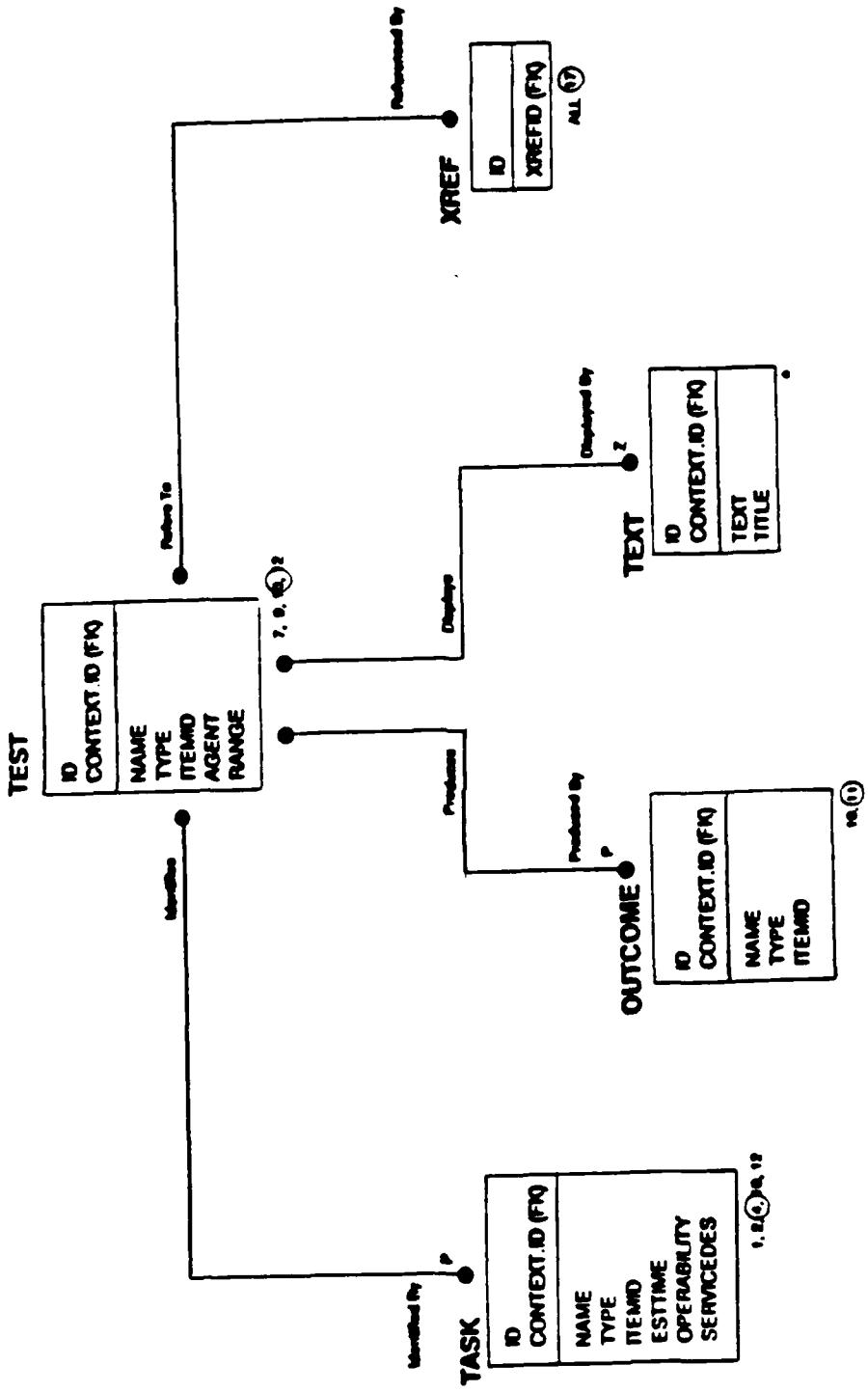
PAGE FIVE OF TROUBLESHOOTING INFORMATION

CHART 11
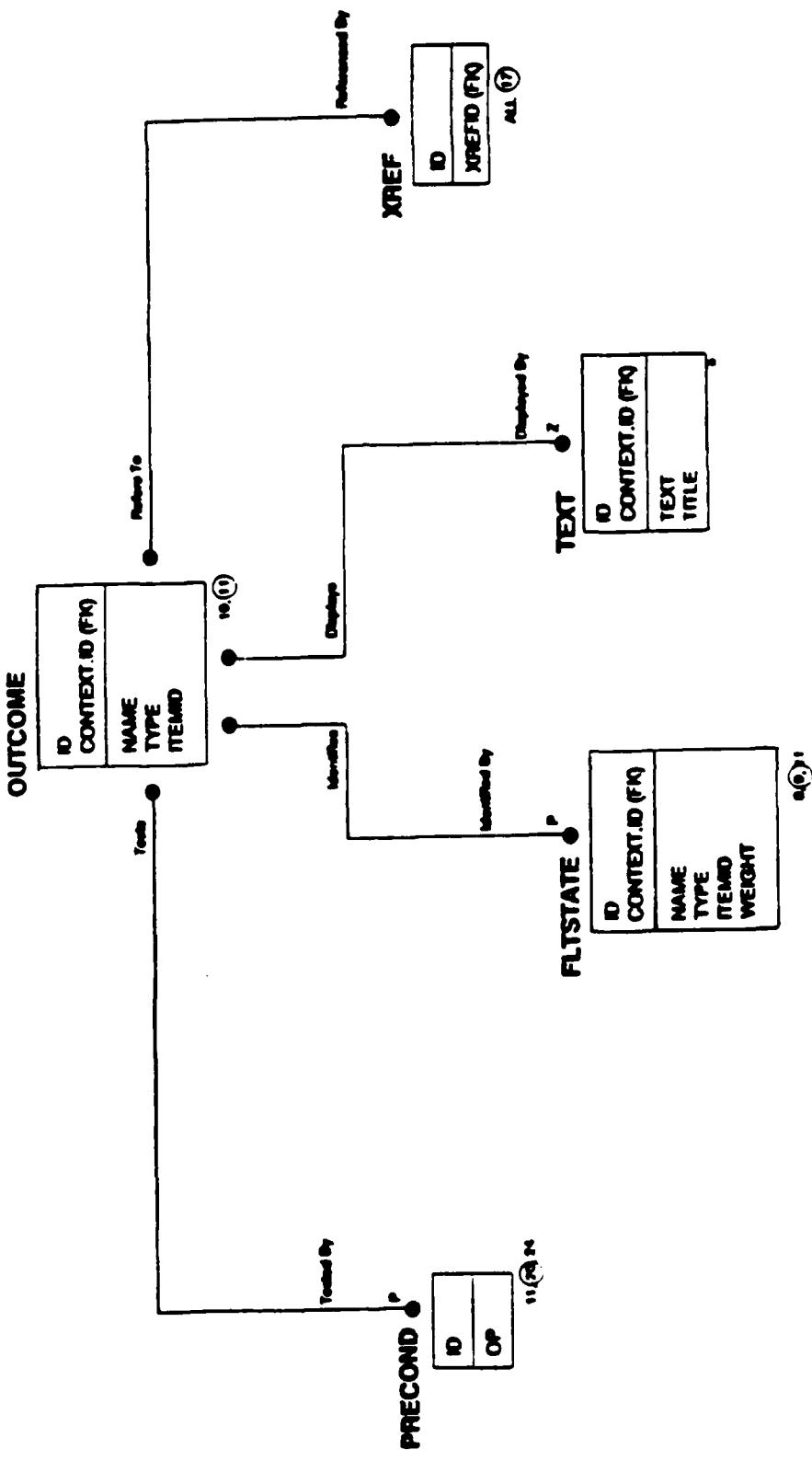
PAGE SIX OF TROUBLESHOOTING INFORMATION

CHART 12
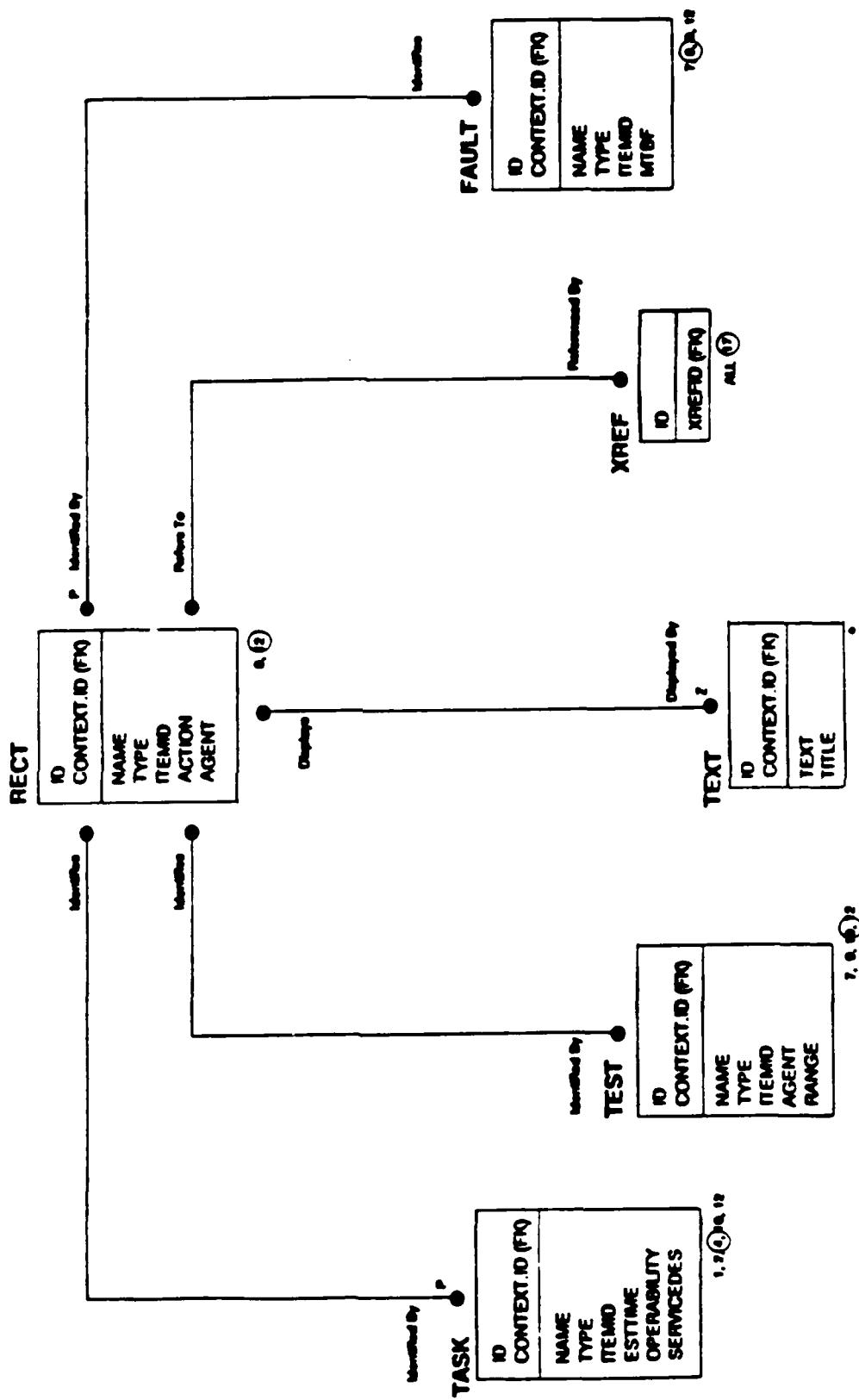
PARIS INFORMATION STRUCTURE
(SUPPLIER AND MAINTAINERS VIEW)
CHART 13
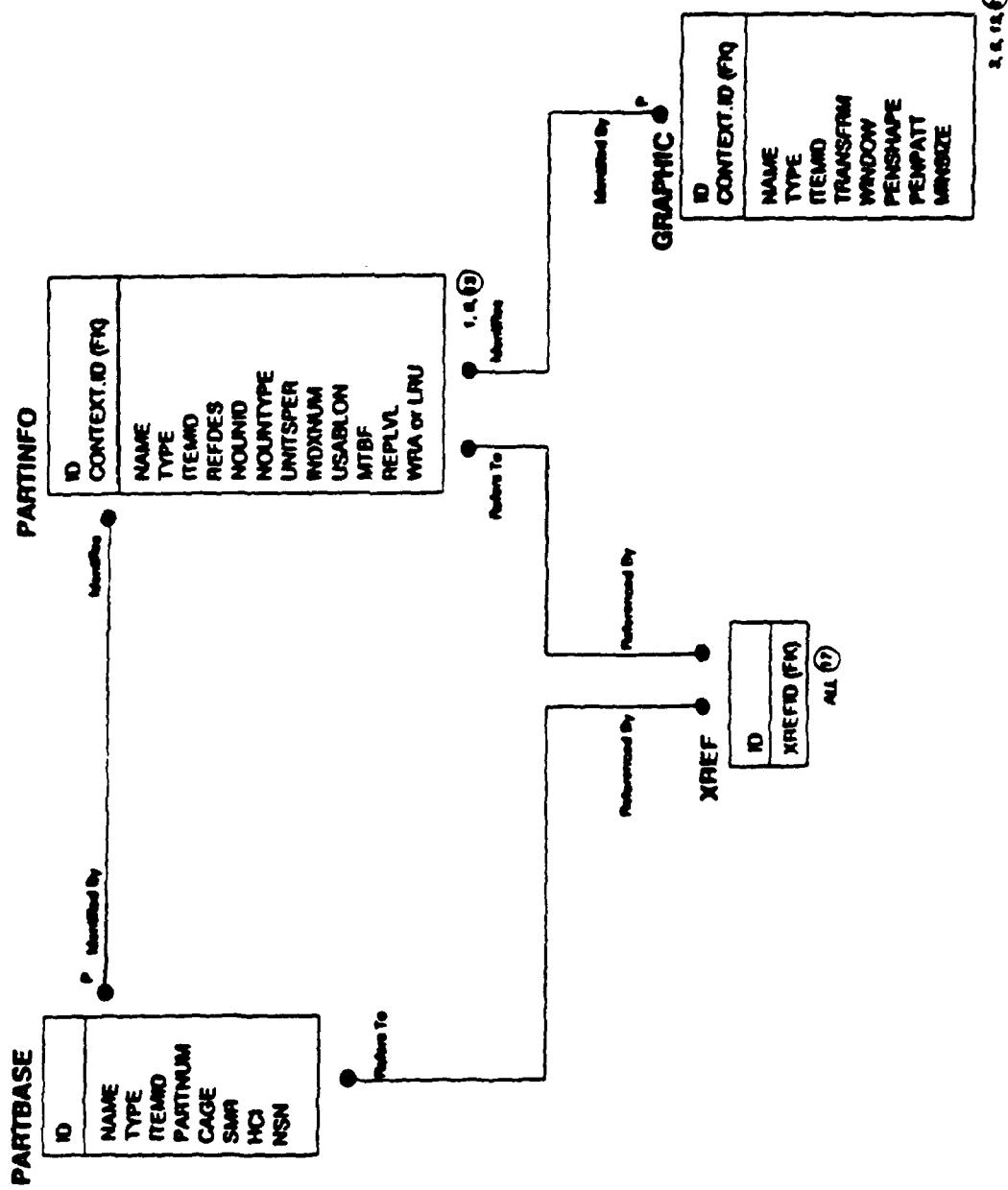
PRIMATIVE ELEMENTS
TEXTUAL INFORMATION
CHART 14

TEXT

| ID |
| CONTEXT.ID (FK) |
| TEXT |
| TITLE |

Relate To

Referenced By

XREF

| ID |
| XREFID (FK) |
| ALL 37 |

*- 3, 6, 8, 9, 10, 11, 12, 14, 15, 16, 18, 18, 19, 20, 23

PRIMATIVE ELEMENTS
GRAPHICS STRUCTURE
CHART 15
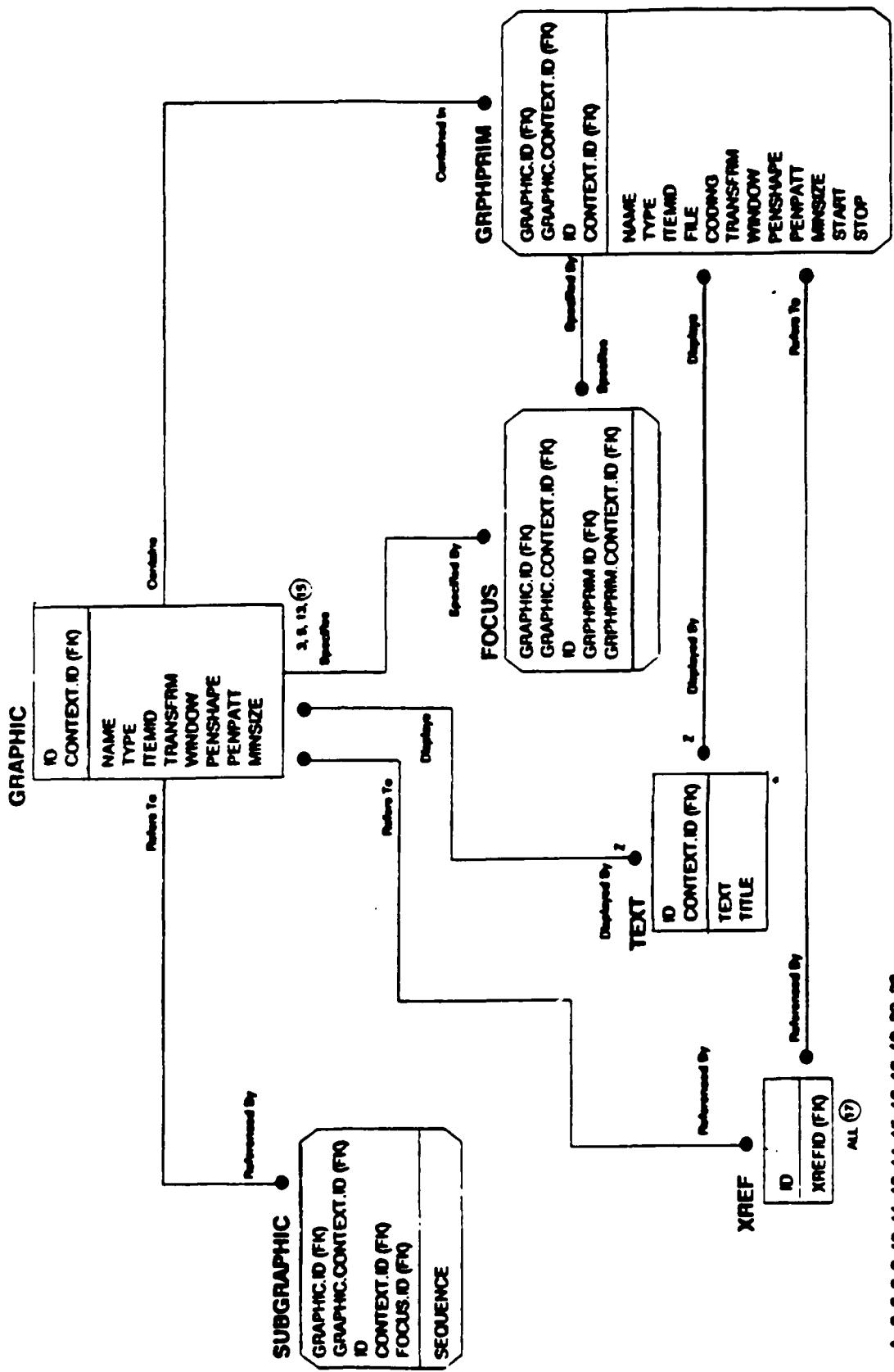
PRIMATIVE ELEMENTS
TABLES STRUCTURE
CHART 16

TABLE
- ID
- CONTEXT.ID (FK)
- NAME
- TYPE
- ITEMID

XREF
- ID
- XREFID (FK)

ENTRY
- TABLE.ID (FK)
- TABLE.CONTEXT.ID (FK)
- ID
- NAME
- TYPE
- ITEMID
- COL
- ROW

TEXT
- ID
- CONTEXT.ID (FK)
- TEXT
- TITLE

ELMNTREF
- ID
- REFERENCE.ID (FK)
- REFERENCE.CONTEXT.ID (FK)

COLHDDEF
- TABLE.ID (FK)
- TABLE.CONTEXT.ID (FK)
- ID
- NAME
- TYPE
- ITEMID
- COLNUM

* - 3, 6, 8, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 23
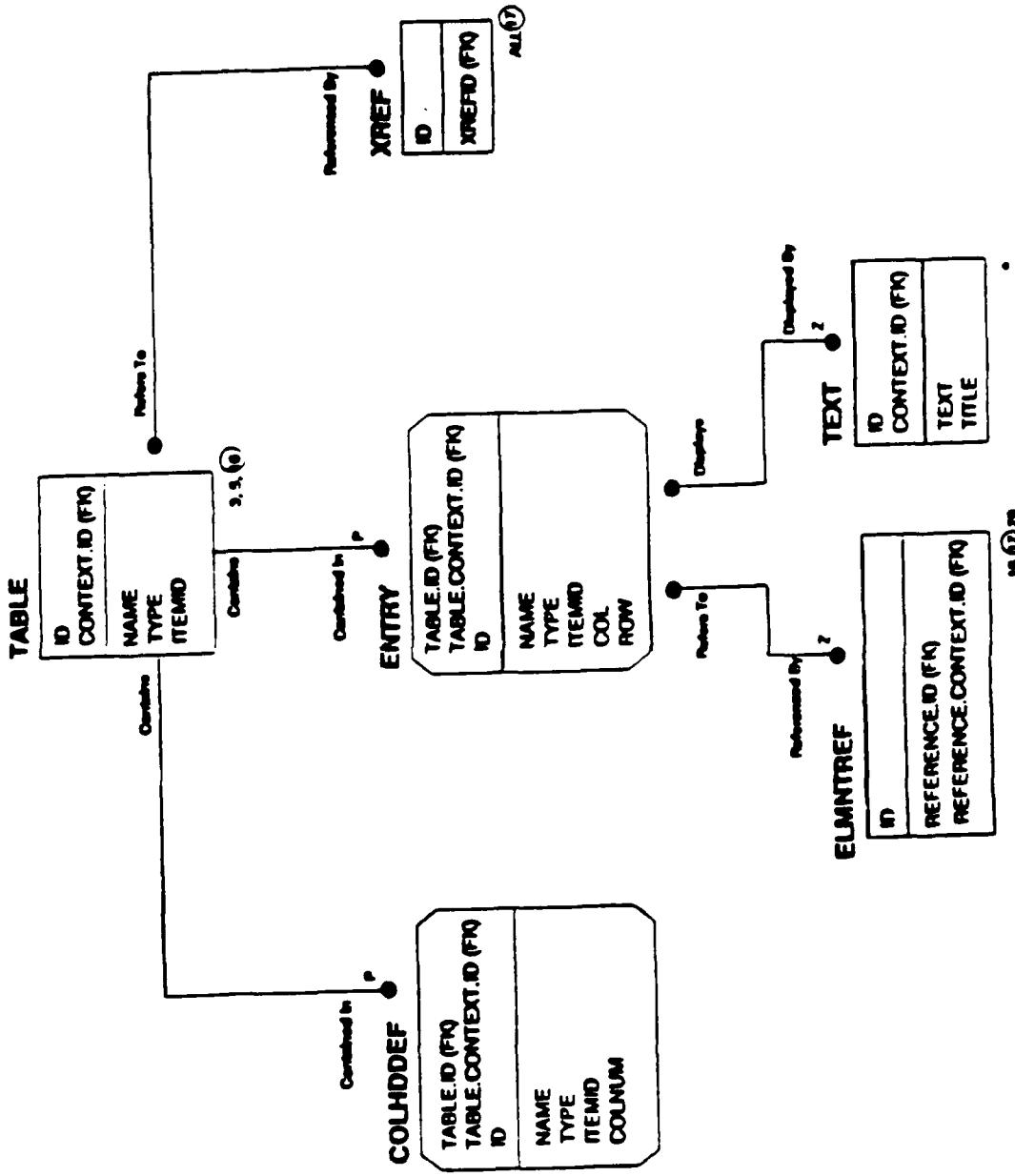
PRIMATIVE ELEMENTS
REFERENCE INFORMATION
CHART 17

REFERENCES
OUTSIDE
OF DATA BASE

ANY ELEMENT
IN DATA BASE

XREF

| ID |
| XREFID (FK) |

ELMNTREF

| ID |
| REFERENCE.ID (FK) |
| REFERENCE CONTEXT.ID (FK) |
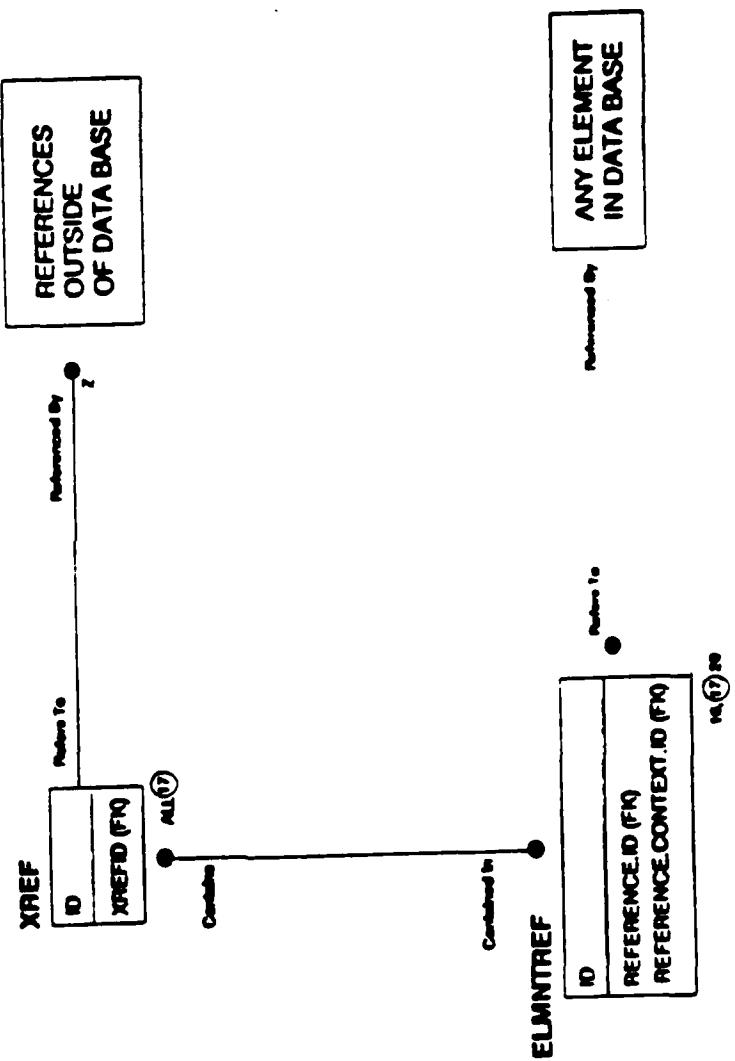
PRIMATIVE ELEMENTS
MESSAGES (WARNING, CAUTIONS, AND NOTES) STRUCTURE
CHART 18
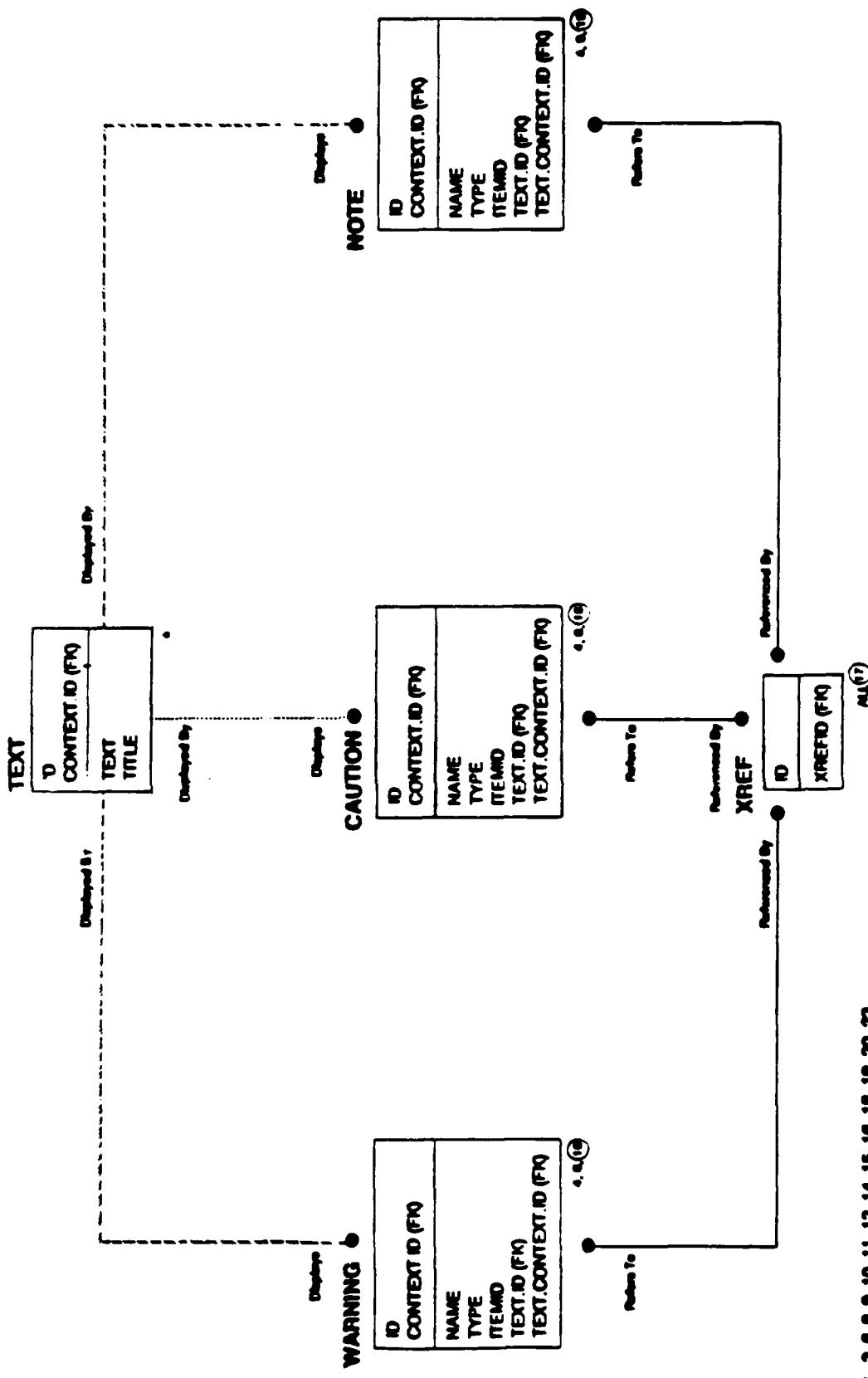
PRIMATIVE ELEMENTS
PROMPT STRUCTURE
CHART 19
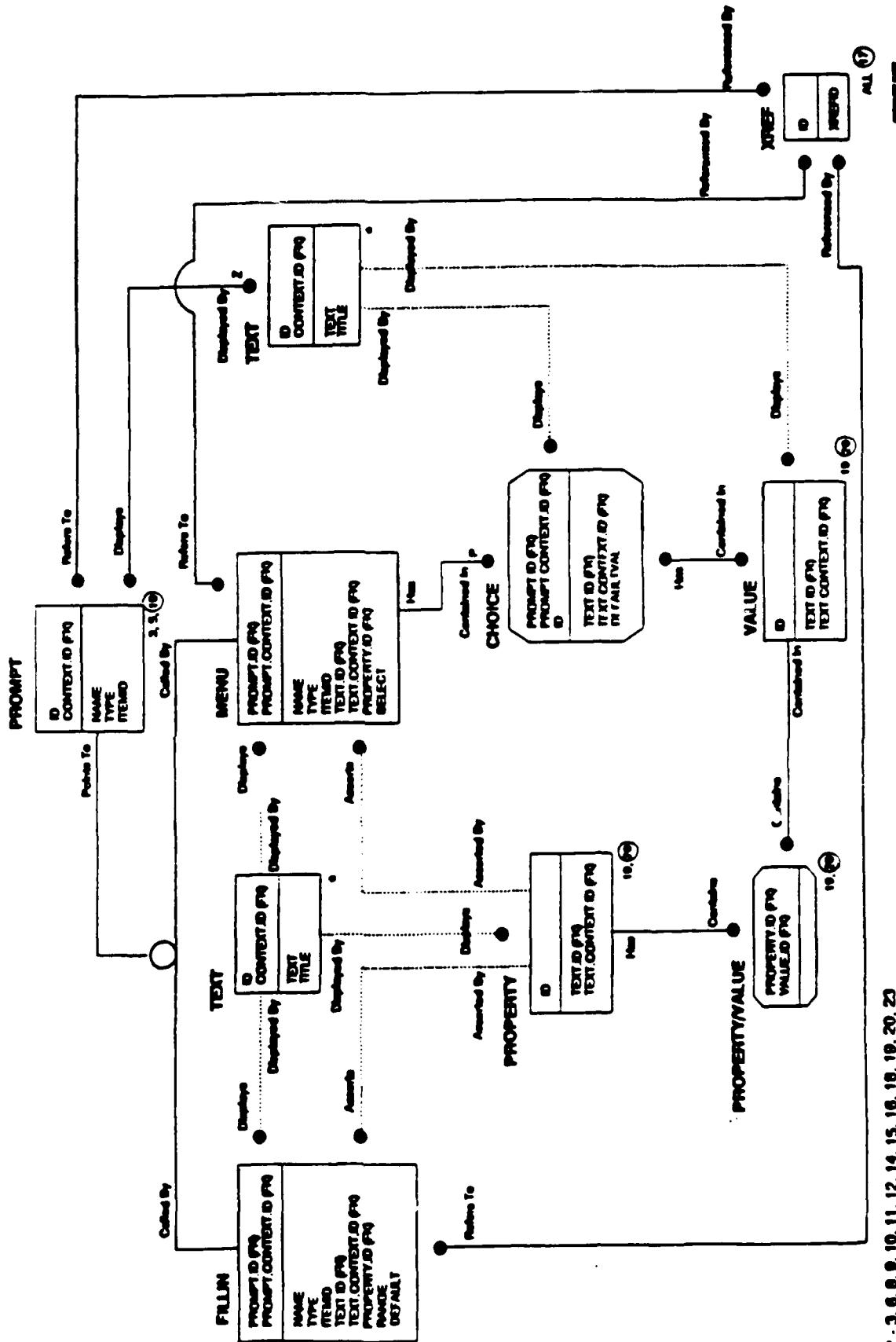
PRIMATIVE ELEMENTS

PROPERTY, VALUE, ASSERTIONS. AND PRECONDITIONS

CHART 20
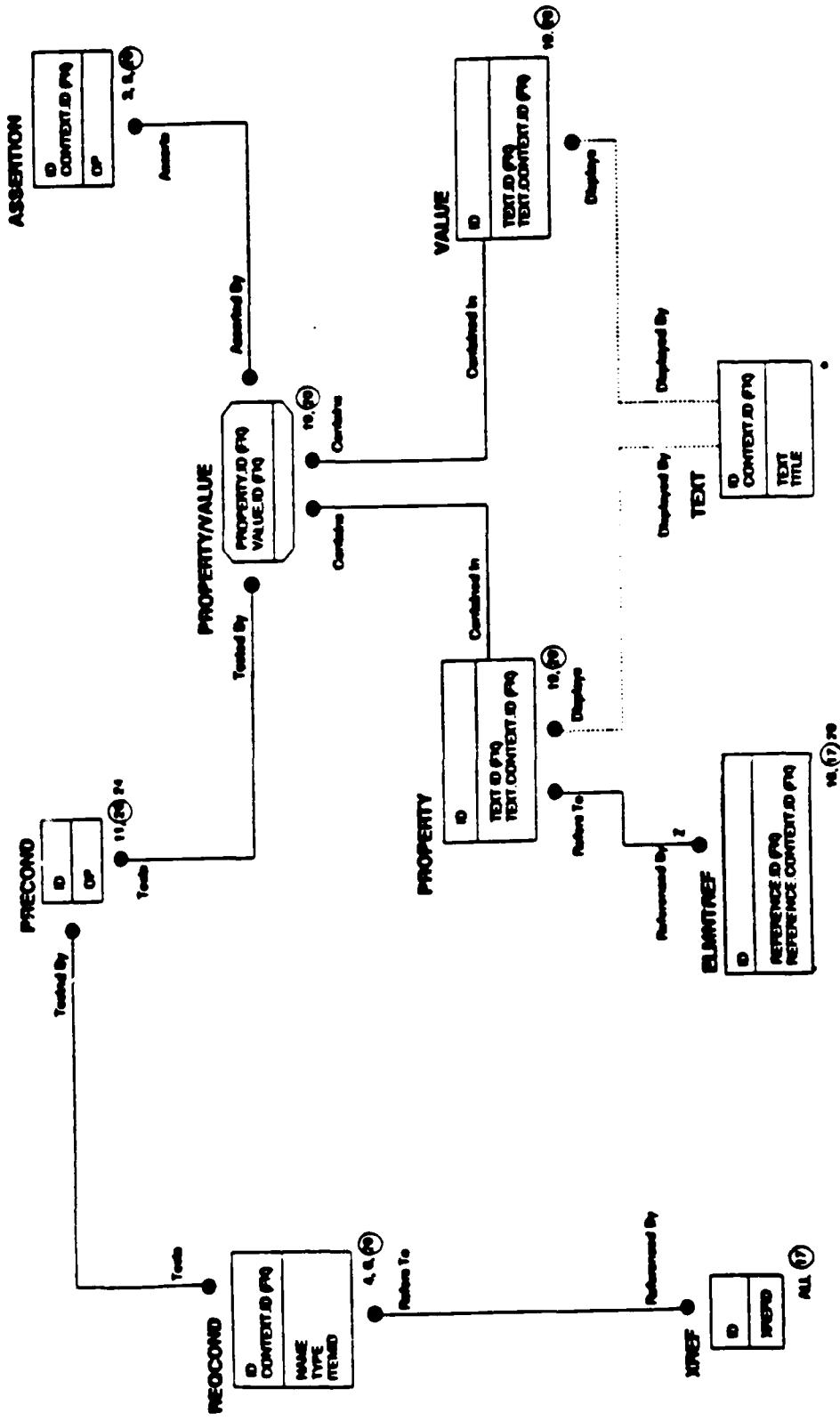
PRIMATIVE ELEMENTS
AUDIO, VIDEO, AND PROCESS STRUCTURES
CHART 21
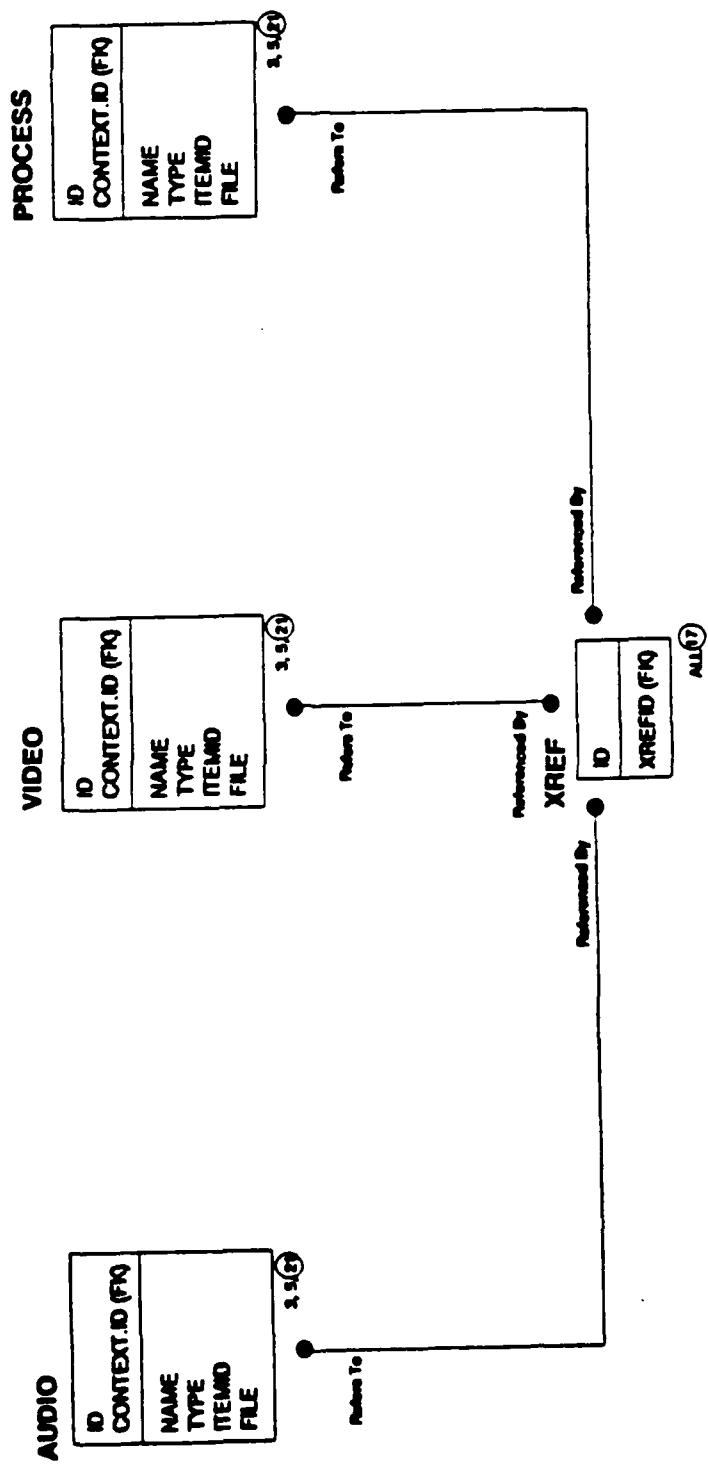
PRIMATIVE ELEMENTS

EQUIPMENT AND CONSUMABLES STRUCTURES

CHART 22

CONSUM
ID
CONTEXT.ID (FK)

NAME
TYPE
ITEMID
MILSPEC
MFGCODE
GOVSTD
NSN
CAGE
ICC
UNITMEASURE
QUANTITY

Refers To

Referenced By

XREF
ID
XREFID (FK)

ALL

EQUIP
ID
CONTEXT.ID (FK)

NAME
TYPE
ITEMID
NSN
CAGE
ICC
QUANTITY

Refers To

Refers To

Refers Back To

ALTEQUID

EQUIP.ID (FK)
EQUIP.CONTEXT.ID (FK)
ID
CONTEXT.ID (FK)
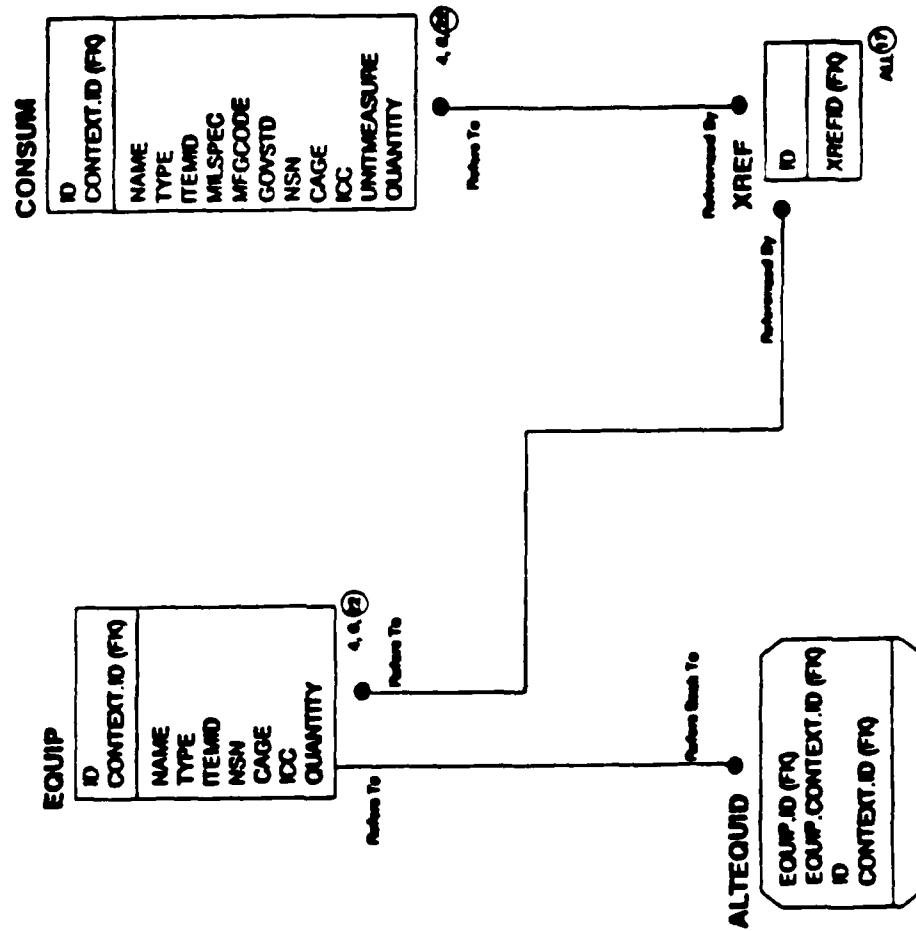
PRIMATIVE ELEMENTS
VERB, ANNOT, AND PERSON STRUCTURES
CHART 23

PRIMATIVE ELEMENTS
CONTEXT STRUCTURE
CHART 24
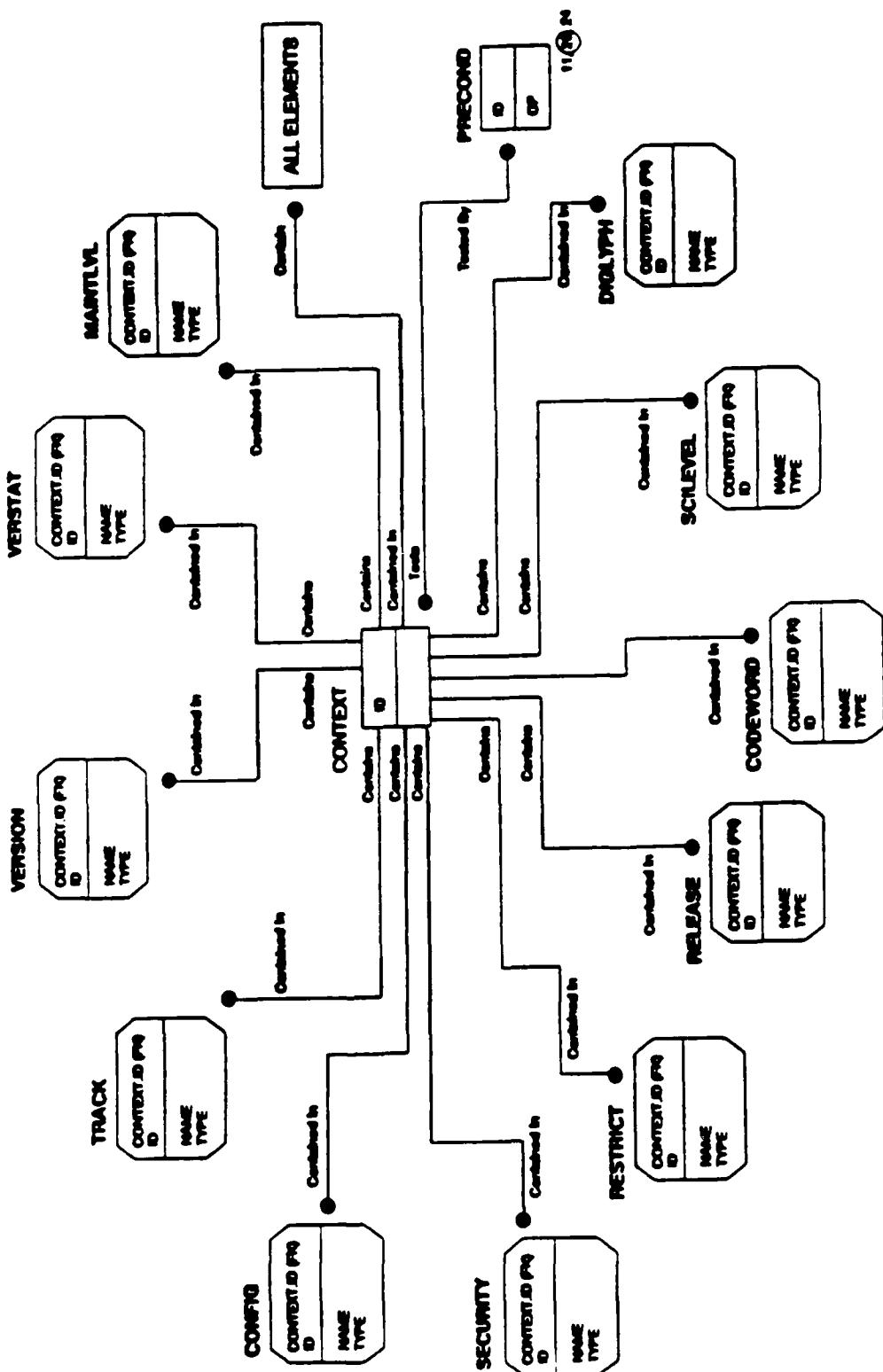
ALL TECHNICAL INFORMATION ELEMENTS HAVE "CONTEXT" AS PART OF THE KEY

APPENDIX C

EXPRESS REPRESENTATION OF REVISABLE IETM DATABASE

This appendix is currently being developed and will be included in the final specification.

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APPENDIX D

NIAM REPRESENTATION OF REVISABLE IETM DATABASE

This appendix is currently being developed and will be included in the final specification.

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APPENDIX E

SGML REPRESENTATION OF REVISABLE IETM DATABASE

<!DOCTYPE   techinfo [

<!--**

          Content Data Model (CDM)
             Version 5.2   5/29/90   DRAFT

This document is an SGML Document Type Definition (DTD) which
describes the logical structure for a database of technical
information. This version is a working draft which is still under
development by the Air Force Human Resources Laboratory (AFHRL/LRC)
at Wright Patterson AFB.

**-->

<!--**

          Entity Declarations

These entity declarations define abbreviations for a set of
frequently used attributes: "id," "refid". The "%ids" entity
declaration defines an abbreviation for two element identifiers
("id" and "refid"). These identifiers are machine generated
symbols used to identify data elements in the database. These
identifiers are not intended to be human readable names, but only
machine readable pointers or references. Most elements in the CDM
have both a unique identifier ("id") and a non-unique reference
identifier ("refid"). The reference identifier ("refid") is used
by elements to refer or "point" to other elements. For example,
a "task" element may refer to a list of "step" elements, or a
"system" element may refer to a list of "subassembly" elements.
Since the reference id ("refid") is not unique, it may refer
to several elements in the database. These referenced elements
will have different "context" (such as version number or security
level) which will be used to determine which unique element is
appropriate for a particular situation. Since SGML requires that
all "ID" attributes be unique, an "ID" attribute cannot be used as
the reference id ("refid"). Instead, "refid" is defined as a
NMTOKEN.

The two entities "%refid" and "%refids" are defined only to improve
readability. They let the reader know that an attribute's value
is meant to be a reference identifier (i.e., a NMTOKEN specifying
some element's "refid"). These two entities, "%refid" and
"%refids," are used throughout the CDM whenever a reference is
intended. This DTD also follows the convention that the attribute
name of any "%refid" attribute is the same as the element name to
which it is referring. For example, the "system" element has an

attribute named "task" which is a "%refids" list intended to
contain only valid "refids" to "task" elements. There is one
notable exception to this rule. In some cases an "elmntref"
attribute is defined which is intended to be a reference to any
element type.

***-->

```
<!ENTITY  %  ids    "id  ID    #REQUIRED
          refid     NMTOKEN   #REQUIRED">

<!ENTITY  % refid   "NMTOKEN">

<!ENTITY  % refids  "NMTOKENS">
```


<!--**

          Notation Declarations

The following notations define external references to "public"
graphics standards used in the CDM. The specified abbreviations
(cgmbin, cgmclear, cgmchar, fax, iges, dxf, gks) are used by the
element "graphprm" to specify the type of graphic representation
used to encode a particular graphic primitive.

***-->

```
<!NOTATION   cgmbin PUBLIC     "ISO    8632/2//NOTATION    Binary
encoding//EN">

<!NOTATION   cgmchar     PUBLIC "ISO 8632/2//NOTATION Character
encoding//EN">

<!NOTATION   cgmclear    PUBLIC "ISO 8632/2//NOTATION Clear text
encoding//EN">

<!NOTATION   fax    PUBLIC "-//USA-DOD//NOTATION CCITT Group 4
Facsimile//EN">

<!NOTATION   iges   PUBLIC "-//USA-DOD//NOTATION Initial Graphics
Exchange Specification//EN">

<!NOTATION   dxf    PUBLIC "-//USA-DOD//NOTATION DXF Encoding//EN"
>

<!NOTATION   gks    PUBLIC "-//USA-DOD//NOTATION Graphics Kernel
```

System//EN" > ·


```
<!--*********************************************************

        CDM Content

"Techinfo"  is the top element of the CDM .   Its content model is
a long list of elements (vehicle*, system*, ... ) which comprise
the raw data "records" or "tables" for  the CDM data base.  The
first "system" element in the data base is the· root or top level
item in the hierarchy.

*******************************************************************-->

<!ELEMENT techinfo - -    ( system*, operinfo*, descinfo*,
                task*,  step*,
                reqcond*, person*, equip*, consum*, verb*,
                warning*, caution*, note*,  annot*,
                partinfo*, partbase*, faultinf* ,
                test*, outcome*,  fltstate*, fault*, rect*,
                text*, title*, dictitem*, xref*, table*, colhddef*,
                entry*, list*, graphic*, grphprim*,
                video*, audio*, process*,
                prompt*, fillin*, menu*, choice*, context*,
                assertion*, precond*, property*, value* )>

<!ATTLIST techinfo  %ids;
        system     %refid;    #REQUIRED>


<!--*********************************************************

        Vehicle - System - Subsystem Hierarchy
```

The CDM specifies a hierarchically organized data base of technical
information for a weapon system. The main hierarchy of the data
base parallels the equipment hierarchy of the weapon system. This
is normally represented as a vehicle - system - subsystem -
subassembly hierarchy in AF Technical Orders. That hierarchy is
represented in the CDM by the "system" element specified below.
Here "system" is used in its most generic sense, meaning any
component or item in the equipment hierarchy. A "system" could
represent the vehicle, an aircraft system, subsystem, or
subassembly.

At any level in this hierarchy (vehicle, system, or subassembly)
elements may reference associated information. They may reference
procedural task information ("task"), descriptive information

("desc"), parts information ("partinfo"), fault information ("faultinf"), or operational information ("operinfo"). This information should be attached to the level where it is most appropriate. For example, vehicle towing procedures should be referenced at the "vehicle" level. The removal task for a circuit card in the radar should be referenced at the radar "system" level.

The "system" element, like most elements in the CDM, have a set of attributes ("name," "type," "itemid," and "xrefs") which describe the nature of the element's content. These include attributes defining the element's "name" and "type". There is also an "itemid" attribute used to indicate which piece of equipment (or "item") is related to the information element. The "itemid" could be a reference designator, a SSSN number, a part number, etc., depending on the item of interest. There is also an attribute "xref" which defines relational links between the element and other elements in the data base. An "xref" specifies the reference identifier for a related element and the type of relation being specified.

```
*****************************************************************-->

<!ELEMENT system     - o   EMPTY  >
<!ATTLIST system     %ids;
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          system     %refids;   #IMPLIED
          operinfo   %refids;   #IMPLIED
          descinfo   %refids;   #IMPLIED
          task       %refids;   #IMPLIED
          partinfo   %refids;   #IMPLIED
          faultinf   %refids;   #IMPLIED
          context    %refids;   #IMPLIED>

<!--*************************************************************

          Operational Information


*****************************************************************-->

<!ELEMENT operinfo   - o   EMPTY  >
<!ATTLIST operinfo   %ids;
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
```

```
              itemid    CDATA      #IMPLIED
              xref      IDREFS     #IMPLIED
              descinfo  %refids;   #IMPLIED
              task      %refids;   #IMPLIED
              context   %refids;        #IMPLIED>
```

```
<!--*************************************************************
```

          Descriptive Information

The element "descinfo" is used to define general purpose,
non-procedural, narrative information such as theory of operation,
schematics, wiring diagrams, etc. "Descinfo" is a very flexible,
general purpose information node. It can be used to describe any
arbitrary,   hierarchical   hypertext-like   node   containing
sub-paragraphs ("descinfo"), data ("text," "table," "graphic,"
"annot,"   "audio,"   "video,"   "process"),   user   interaction
instructions ("prompt"), and assertion properties ("assertion")
which are asserted whenever the "descinfo" is read.

```
*************************************************************-->
```

```
<!ELEMENT descinfo   - o    EMPTY >
<!ATTLIST descinfo   %ids;
              name      CDATA      #IMPLIED
              type      CDATA      #IMPLIED
              itemid    CDATA      #IMPLIED
              xref      IDREFS     #IMPLIED
              assertion IDREFS     #IMPLIED
              descinfo  %refids;   #IMPLIED
              text      %refid;    #IMPLIED
              table     %refids;   #IMPLIED
              graphic   %refids;   #IMPLIED
              audio     %refids;   #IMPLIED
              video     %refids;   #IMPLIED
              process   %refids;   #IMPLIED
              annot     %refids;   #IMPLIED
              prompt    %refids;   #IMPLIED
              context   %refids;   #IMPLIED>
```

```
<!--*************************************************************
```

          Task Information

The elements "task," and "step" define a maintenance task or
procedure. A "task" consists of a set of input conditions,
a list of steps ("step"), a list of follow-on tasks ("followon"),
and the attributes estimated time ("esttime") and action describing

"verb". The elements "reqcond" (required conditions), "person"
(personnel required), "equip" (equipment required), "consum"
(consumables), and "verb" describe the input conditions referred
to by "step". The additional elements "warning," "caution," "note,"
and "annot" (user annotations) are referenced by "step".

```
*************************************************************-->

<!ELEMENT task - o      EMPTY >
<!ATTLIST task          %ids;
          step          %refids;   #REQUIRED
          name          CDATA      #IMPLIED
          type          CDATA      #IMPLIED
          itemid        CDATA      #IMPLIED
          operability   CDATA      #IMPLIED
          servicedes    CDATA      #IMPLIED
          xref          IDREFS     #IMPLIED
          esttime       NUTOKENS   #IMPLIED
          verb          %refids;   #IMPLIED
          reqcond       %refids;   #IMPLIED
          person        %refids;   #IMPLIED
          equip         %refids;   #IMPLIED
          consum        %refids;   #IMPLIED
          warning       %refids;   #IMPLIED
          caution       %refids;   #IMPLIED
          note          %refids;   #IMPLIED
          followon      %refids;   #IMPLIED
          context       %refids;   #IMPLIED>


<!ELEMENT step - o      EMPTY >
<!ATTLIST step          %ids;
          text          %refid;    #REQUIRED
          name          CDATA      #IMPLIED
          type          CDATA      #IMPLIED
          itemid        CDATA      #IMPLIED
          xref          IDREFS     #IMPLIED
          esttime       NUTOKENS   #IMPLIED
          assertion     IDREFS     #IMPLIED
          step          %refids;   #IMPLIED
          table         %refids;   #IMPLIED
          graphic       %refids;   #IMPLIED
          audio         %refids;   #IMPLIED
          video         %refids;   #IMPLIED
          process       %refids;   #IMPLIED
          annot         %refids;   #IMPLIED
          prompt        %refids;   #IMPLIED
          warning       %refids;   #IMPLIED
          caution       %refids;   #IMPLIED
```

```
                note·       %refids;   #IMPLIED
                verb        %refids;   #IMPLIED
                reqcond     %refids;   #IMPLIED
                person      %refids;   #IMPLIED
                equip       %refids;   #IMPLIED
                consum      %refids;   #IMPLIED
                context     %refids;   #IMPLIED>


<!ELEMENT reqcond       - o     EMPTY >
<!ATTLIST reqcond       %ids;
                name        CDATA      #IMPLIED
                type        CDATA      #IMPLIED
                itemid      CDATA      #IMPLIED
                xref        IDREFS     #IMPLIED
                precond     IDREFS     #IMPLIED
                elmntref    %refids;   #IMPLIED
                context     %refids;   #IMPLIED>


<!ELEMENT person        - o     EMPTY >
<!ATTLIST person        %ids;
                name        CDATA      #IMPLIED
                type        CDATA      #IMPLIED
                itemid      CDATA      #IMPLIED
                xref        IDREFS     #IMPLIED
                context     %refids;   #IMPLIED>


<!ELEMENT equip         - o     EMPTY >
<!ATTLIST equip         %ids;
                name        CDATA      #IMPLIED
                type        CDATA      #IMPLIED
                itemid      CDATA      #IMPLIED
                xref        IDREFS     #IMPLIED
                nsn         CDATA      #IMPLIED
                cage        CDATA      #IMPLIED
                icc.        CDATA      #IMPLIED
                alteqids    CDATA      #IMPLIED
                qty         NMTOKEN    #IMPLIED
                context     %refids;   #IMPLIED>


<!ELEMENT consum        - o   EMPTY >
<!ATTLIST consum        %ids;
                milspec     CDATA      #REQUIRED
                mfgcode     CDATA      #REQUIRED
                govstd      CDATA      #REQUIRED
                qty         NMTOKEN    #REQUIRED
```

```
                name·        CDATA        #IMPLIED
                type         CDATA        #IMPLIED
                itemid       CDATA        #IMPLIED
                xref         IDREFS       #IMPLIED
                nsn          CDATA        #IMPLIED
                cage         CDATA        #IMPLIED
                icc          CDATA        #IMPLIED
                uom          CDATA        #IMPLIED
                context     %refids;      #IMPLIED>


<!ELEMENT verb - o    EMPTY >
<!ATTLIST verb %ids;
                name         CDATA        #IMPLIED
                type         CDATA        #IMPLIED
                itemid       CDATA        #IMPLIED
                xref         IDREFS       #IMPLIED
                context %refids;          #IMPLIED>
                <!-- Deleted verbsymb.  Name is enough. -->


<!ELEMENT warning    - o    EMPTY >
<!ATTLIST warning    %ids;
                text         %refid;      #REQUIRED
                name         CDATA        #IMPLIED
                type         CDATA        #IMPLIED
                itemid       CDATA        #IMPLIED
                xref         IDREFS       #IMPLIED
                context %refids;          #IMPLIED>


<!ELEMENT caution    - o    EMPTY ' >
<!ATTLIST caution    %ids;
                text         %refid;      #REQUIRED
                name         CDATA        #IMPLIED
                type         CDATA        #IMPLIED
                itemid       CDATA        #IMPLIED
                xref         IDREFS       #IMPLIED
                context %refids;          #IMPLIED>


<!ELEMENT note - o    EMPTY  >
<!ATTLIST note        %ids;
                text         %refid;      #REQUIRED
                name         CDATA        #IMPLIED
                type         CDATA        #IMPLIED
                itemid       CDATA        #IMPLIED
                xref         IDREFS       #IMPLIED
                context %refids;          #IMPLIED>
```

```
<!ELEMENT annot        - o    EMPTY >
<!ATTLIST annot        %ids;
          text         %refid;    #REQUIRED
          name         CDATA      #IMPLIED
          type         CDATA      #IMPLIED
          itemid       CDATA      #IMPLIED
          xref         IDREFS     #IMPLIED
          user         CDATA      #IMPLIED
          context %refids;        #IMPLIED>


<!--*******************************************************************

          Parts Information

The  elements  "partinfo"  and  "partbase"  define  detailed  parts
information.  "Partinfo"  describes  an  item  by  its  reference
designator ("refdes") which categorizes parts by their place in the
system-subsystem hierarchy. "Partinfo" describes the maintainer's
view of the part information. Each "partinfo" element is related
to  a  "partbase"  which  describes  the  item  in  terms  of  its  part
number  ("partnum").  "Partbase" describes the supply system's view
of the part information.  Several "partinfo" items could be related
to the same "partbase."

**********************************************************************-->


<!ELEMENT partinfo  - o    EMPTY >
<!ATTLIST partinfo         %ids;
          partbase         IDREFS     #REQUIRED
          refdes           NMTOKEN    #REQUIRED
          unitsper         NUTOKEN    #REQUIRED
          indxnum          NUTOKEN    #REQUIRED
          mtbf             CDATA      #REQUIRED
          graphic          %refids;   #REQUIRED
          usablon          NUTOKEN    #REQUIRED
          name             CDATA      #IMPLIED
          type             CDATA      #IMPLIED
          itemid           CDATA      #IMPLIED
          xref             IDREFS     #IMPLIED
          nounid           NUTOKEN    #IMPLIED
          nountype         NUTOKEN    #IMPLIED
          replvl           CDATA      #IMPLIED
          lru              NUTOKEN    #IMPLIED
          context          %refids;   #IMPLIED>

<!ELEMENT partbase  - o    EMPTY >
```

```
<!ATTLIST partbase   %ids;
          partnum    CDATA      #REQUIRED
          cage       CDATA      #REQUIRED
          smr        CDATA      #REQUIRED
          hci        CDATA      #REQUIRED
          nsn        CDATA      #REQUIRED
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          context    %refids;   #IMPLIED>
```

```
<!--************************************************************
```

Fault Information

Three types of fault information can be described in the CDM: (A) fault reporting decision trees, (B) fault isolation decision trees, and (C) dynamic fault isolation models (such as AFHRL's MDAS model).   The fault reporting and isolation decision trees are static, predefined decision sequences.   A dynamic fault model generates the decision sequence at display time from a fault model of the equipment.   In the case of a decision tree, the complete tree is defined in the data.   In the case of a dynamic fault isolation model, only the data needed to represent the fault model of the equipment is defined in the data.

Any of these diagnostic data structures can be described in terms of diagnostic tests ("test"), test outcomes ("outcome"), fault states ("fltstate"), repairable faults ("fault"), and fault rectification actions ("rect").   The general logic is that you begin a fault reporting or isolation process with a "test," which may be as simple as "what symptoms did you observe?," or as a complex as a 50-step checkout procedure.   Each "test" will have associated "outcomes" which associate possible test results with new fault states ("fltstate").   Test results are described as "precond" statements (e.g., voltage = 4.5v., light = dim, faultcode = A123, ...) which are asserted by the "test" procedure as the test is performed.   The "outcome" elements relate those possible test results to fault states.

A "fltstate" state represents a node in a fault isolation decision tree or a set of plausible faults in a dynamic fault model .   A "fltstate" state provides the information necessary to select the next diagnostic test.   In a decision tree the test is explicitly identified by the "test" attribute of "fltstate."   In a dynamic fault model, the "test" is not explicitly identified (i.e., the

"test" attribute is empty), and the "fltstate" specifies a list of implicated faults ("impfault") and a list of exculpated faults ("expfault") for that state. Implicated faults are those which are suspected as being bad in the fault state. Exculpated faults are those known to be good in the fault state. These fault lists are then used by dynamic software to generate a list of appropriate "tests" which will further isolate the list of implicated faults. No matter how the test is selected, statically by the data or dynamically by the software, the selected "test" is performed and the process continues until a fault is isolated. In a decision tree a fault is identified when you reach a final "fltstate" node which does not reference a "test," but lists the identified "fault." In a dynamic fault model, the final fault is identified by the software and is not explicitly represented in the "fltstate" element.

Once a "fault" is identified, the rectification (i.e, repair) procedure ("rect") associated with the "fault" is performed. Rectification actions also have an associate "test" which is generally a checkout task to verify that the rectification action successfully fixed the problem. The "rect" element also has a fault attribute which is a list of faults that identifies all of the faults repaired by the rectification action.

Tests and rectifications can be performed by a human or machine agent. The elements "test" and "rect" have an "agent" attribute which states whether the action is performed by a human or a machine.

```
************************************************************-->


<!ELEMENT faultinf   - o   EMPTY >
<!ATTLIST faultinf   %ids;
          test       %refids;   #REQUIRED
          fault      %refids;   #REQUIRED
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          context    %refids;   #IMPLIED>

<!-- Deleted faultrep, faultiso, and faultmodel, these can be
     represented in "type" -->


<!ELEMENT test - o   EMPTY >
<!ATTLIST test %ids;
          task        %refids;  #REQUIRED
```

```
                outcome    %refids;    #REQUIRED
                name       CDATA       #IMPLIED
                type       CDATA       #IMPLIED
                itemid     CDATA       #IMPLIED
                xref       IDREFS      #IMPLIED
                text       %refid;     #IMPLIED
                agent      ( human | machine )  "human"
                range      CDATA       #IMPLIED
                context    %refids;    #IMPLIED>


<!ELEMENT outcome    - o    EMPTY  >
<!ATTLIST outcome    %ids;
                precond    IDREFS      #REQUIRED
                fltstate   %refids;    #REQUIRED
                name       CDATA       #IMPLIED
                type       CDATA       #IMPLIED
                itemid     CDATA       #IMPLIED
                xref       IDREFS      #IMPLIED
                text       %refid;     #IMPLIED
                context    %refids;    #IMPLIED>


<!ELEMENT fltstate   - o    EMPTY >
<!ATTLIST fltstate   %ids;
                name       CDATA       #IMPLIED
                type       CDATA       #IMPLIED
                itemid     CDATA       #IMPLIED
                xref       IDREFS      #IMPLIED
                text       %refid;     #IMPLIED
                expfault   %refids;    #IMPLIED
                impfault   %refids;    #IMPLIED
                weight     NUTOKENS    #IMPLIED
                test       %refid;     #IMPLIED
                context    %refids;    #IMPLIED>


<!ELEMENT fault      - o    EMPTY >
<!ATTLIST fault      %ids;
                rect       %refids;    #REQUIRED
                name       CDATA       #IMPLIED
                type       CDATA       #IMPLIED
                itemid     CDATA       #IMPLIED
                xref       IDREFS      #IMPLIED
                mtbf       CDATA       #IMPLIED
                fault      %refids;    #IMPLIED
                text       %refid;     #IMPLIED
                partinfo   %refids;    #IMPLIED
                context %refids;            #IMPLIED>
```

```
<!ELEMENT rect - o    EMPTY >
<!ATTLIST rect        %ids;
          task        %refids;   #REQUIRED
          name        CDATA      #IMPLIED
          type        CDATA      #IMPLIED
          itemid      CDATA      #IMPLIED
          xref        IDREFS     #IMPLIED
          action      ( swap | maint )     "swap"
          agent       ( human | machine )  "human"
          text        %refid;    #IMPLIED
          test        %refids;   #IMPLIED
          fault       %refids;   #IMPLIED
          context     %refids;   #IMPLIED>


<!--***********************************************************

          Text Elements

"Text" is the primitive text element referenced by more complex
data elements in the CDM.  A "text" unit is basically a text string
of "parsable character data" or PCDATA.  Within a text string,
attribute values ("attvalue") of other CDM elements may be
referer~ed and inserted as text string.  For example, the string
may contain a reference to a standard system name, or a standard
part nomenclature, or a standard task name.  "Attvalue" may be used
to embed one of these references in string which tells the display
system to find the value of the referenced attribute and place that
value into the text string for display.  By using this mechanism,
standard terminology can be referenced consistently throughout the
data base, and any changes to the standard terminology can be made
in one location and automatically updated throughout the data base.


************************************************************-->

<!ELEMENT text - -    ( #PCDATA  |  attvalue)+ >
<!ATTLIST text        %ids;
          name        CDATA            #IMPLIED
          type        (TEXT | TITLE)   #IMPLIED
          itemid      CDATA            #IMPLIED
          xref        IDREFS           #IMPLIED
          context     %refids;         #IMPLIED>


<!ELEMENT title       - -  ( #PCDATA  |  attvalue )+  >
<!ATTLIST title       %ids;
          name        CDATA      #IMPLIED
```

```
                type       CDATA      #IMPLIED
                itemid     CDATA      #IMPLIED
                xref       IDREFS     #IMPLIED
                context    %refids;   #IMPLIED>


<!ELEMENT dictitem  - o   EMPTY >
<!ATTLIST dictitem  %ids;
                name       CDATA      #REQUIRED
                def        %refids    #REQUIRED
                type ( gloss | abbsym | symbol | other )      "other"
                itemid     CDATA      #IMPLIED
                xref       IDREFS     #IMPLIED
                context    %refids;   #IMPLIED>


<!ELEMENT attvalue  - o   EMPTY >
<!ATTLIST attvalue  elmntref  %refid;    #REQUIRED
                attname    NAME "name"
                context %refids;           #IMPLIED>



<!--*********************************************************

        Element Cross References

The element "xref" defines a cross reference or relational link.
Each cross reference has at least one %refid which may be an
internal reference (pointing to an element within a particular CDM
data base) or an external reference (pointing to an element outside
of the CDM).   Internal references are represented by "elmntref"
which is a reference id for any CDM element. External references
are represented by "exrefid" which is character data describing
another file or data base element. All cross references may have
a type ("relation") which is a text string describing the nature
of the reference (e.g., "theory," "IPB," "schematic").   There is
an optional attribute "attname" which may be used to narrow the
"xref" to a particular attribute value of the cross-referenced
element.

*********************************************************-->


<!ELEMENT xref - o   EMPTY >
<!ATTLIST xref id    ID         #REQUIRED
            relation   CDATA      #IMPLIED
            elmntref   %refids;   #IMPLIED
            attname    NAMES      #IMPLIED
```

```
                exrefid   CDATA       #IMPLIED
                context &refids;      #IMPLIED>



<!--*************************************************** ****

        Tables and Lists

"Table," "colhddef," and "entry" define the structure for a table
of
information.  The cells or "entries"  of a table may be a "text"
unit
or any element identified by an "refid."

A "list" is a general purpose structure used to group individual
elements into a list of elements which share a common EMPTY For
example, if you wanted to specify that a list of steps were all to
be performed if a certain precondition were true, you could group
those steps into a list with a single EMPTYwhich specified the
desired precondition.

*************************************************************-->

<!ELEMENT table      - -    EMPTY >
<!ATTLIST table      %ids;
        colhddef  IDREFS    #REQUIRED
        entry     IDREFS    #REQUIRED
        name      CDATA     #IMPLIED
        type      CDATA     #IMPLIED
        itemid    CDATA     #IMPLIED
        xref      IDREFS    #IMPLIED
        context   &refids;  #IMPLIED>


<!ELEMENT colhddef   - o  EMPTY>
<!ATTLIST colhddef   id   ID    #REQUIRED
        colnum    NUTOKEN   #REQUIRED
        name      CDATA     #IMPLIED
        type      CDATA     #IMPLIED
        context &refids;       #IMPLIED>

<!ELEMENT entry      - o  EMPTY>
<!ATTLIST entry      id   ID    #REQUIRED
        col       NUTOKEN   #REQUIRED
        row       NUTOKEN   #REQUIRED
        text      &refid;   #IMPLIED
        elmntref  &refid;   #IMPLIED
        context &refids;       #IMPLIED>
```

```
<!ELEMENT list - o    EMPTY >
<!ATTLIST list %ids;
        elmntref    %refids;   #REQUIRED
        context     %refids;   #IMPLIED>
```

```
<!--************************************************************
```

Graphics

The CDM allows graphics to be referenced from external graphics files or embedded in the CDM data base. The element "grphprim" may contain a "file" name which identifies an external file containing a graphic data in any of the enumerated formats (cgm, iges, dxf, fax, ...). The same graphic data may also be included directly in the CDM by putting the data in the "#PCDATA " content portion of a "grphprim" element.

Both "graphic" and "graphprim" have a set of optional attributes to specify transformations (i.e., scaling, translating, rotating, clipping, etc.). A "graphic" or "grphrim" element may specify a transformation matrix ("transfrm"), a clipping "window," a pen shape ("penshape"), a pen pattern ("penpatt"), and a label ("text"). Transformations ("transfrm") are specified by a 9-number transformation matrix which specifies coordinate translation, scaling, reflection, and rotation in terms of homogeneous coordinates (see Chapter 3 of Rodgers, D.F., and Adams, J.A., "Mathematical Elements For Computer Graphics," McGraw Hill, 1976, for a complete definition of this matrix).

Composite graphics may be constructed by grouping transformed graphics ("graphic" or "grphprim") into a "graphic" element. These transformed, labelled, named, and typed graphic illustrations are then referenced by steps and para tags in the CDM. A composite "graphic" may also specify a list of "focus" objects which are the subgraphics of interest in that particular illustrations. This attribute could be used to specify which subgraphics in an illustration are to be highlighted, labelled, etc., by the presentation software.

"Graphic" and "grphprim" also may specify a minimum size ("minsize") required to satisfactorily display the graphic to the user. The minimum size is specified in terms of the amount of visual angle the graphic image should subtend on the eye. This

will allow different display systems with different viewing
distances to adjust the physical size of the graphic to provide the
correct visual image as intended by the author.

```
****************************************************************-->



<!ELEMENT graphic    - o    EMPTY >
<!ATTLIST graphic    %ids;
         graphic    %refids;   #REQUIRED
         name       CDATA      #IMPLIED
         type ( normal | locat | overlay |
             schem | functblk | wiring |
                   engin )    #IMPLIED
         itemid     CDATA      #IMPLIED
         xref       IDREFS     #IMPLIED
         text       %refid;    #IMPLIED
         focus      %refids;   #IMPLIED
         transfrm   NUTOKENS   #IMPLIED
         window     NUTOKENS   #IMPLIED
         penshape   CDATA      #IMPLIED
         penpatt    CDATA      #IMPLIED
         minsize    NUTOKENS   #IMPLIED
         context %refids;      #IMPLIED>

<!-- tgraphic was deleted and incorporated into graphic -->


<!ELEMENT grphprim   - -   ( #PCDATA )>
<!ATTLIST grphprim   %ids;
         name       CDATA      #IMPLIED
         type ( normal | locat | overlay |
             schem | functblk | wiring |
             engin )    #IMPLIED
         itemid     CDATA      #IMPLIED
         xref       IDREFS     #IMPLIED
         text       %refid;    #IMPLIED
         file       CDATA      #IMPLIED
         coding     (cgmchar | cgmbin | cgmclear |
             fax | iges | dxf | gks)   "cgmbin"
         transfrm   NUTOKENS   #IMPLIED
         window     NUTOKENS   #IMPLIED
         penshape   CDATA      #IMPLIED
         penpatt    CDATA      #IMPLIED
         minsize    NUTOKENS   #IMPLIED
         start      NUTOKEN    #IMPLIED
         stop       NUTOKEN    #IMPLIED
         context    %refids;   #IMPLIED>
```

```
<!--**********************************************************


          Audio - Video - Process

The elements "audio," "video," and "process" are references to
either a file name or an external source which contains an audio
sequence, a video sequence, or a software process, respectively.

*******************************************************-->

<!ELEMENT audio      - o    EMPTY >
<!ATTLIST audio      %ids;
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          file       CDATA      #IMPLIED
          exrefid    CDATA      #IMPLIED
          context %refids;         #IMPLIED>


<!ELEMENT video      - o    EMPTY >
<!ATTLIST video      %ids;
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          file       CDATA      #IMPLIED
          exrefid    CDATA      #IMPLIED
          context    %refids;   #IMPLIED>


<!ELEMENT process    - o    EMPTY  >
<!ATTLIST process    %ids;
          name       CDATA      #IMPLIED
          type       CDATA      #IMPLIED
          itemid     CDATA      #IMPLIED
          xref       IDREFS     #IMPLIED
          file       CDATA      #IMPLIED
          exrefid    CDATA      #IMPLIED
          context %refids;         #IMPLIED>


<!--**********************************************************
```

Prompts

A "prompt" specifies either a fill-in-the-blank ("fillin") or menu
choice ("menu") question for the user. Prompts are characterized
in terms of property-value pairs (like assertions and
preconditions). Basically, each prompt is associated with a
"property" which specifies the property which will be asserted
along with the user's response when the prompt is answered.
If the prompt is a "fillin" the user's response will be asserted
as the "value" of the specified "property". If the prompt is a
"menu," the user's "choice" selection from the menu will have an
associated "value" which will be asserted as the "value" of the
prompt's "property". Once this assertion is made, other elements
in the system may use the information to test preconditions
("precond") concerning the asserted property.

The "text" of a prompt is the question which will be displayed to
the user. The "text" of a "choice" is the menu choice which will
be displayed to the user as his list of possible menu selections.

Both "fillin" and "menu" prompts can have a "default" value. In
the case of a "fillin," the "default" is a text string ("CDATA")
which will used as the initial entry in the fill-in-the-blank form.
In the case of a "menu," the default will be an IDREF(S) to one of
the possible "choice" responses.

```
*****************************************************************-->

<!ELEMENT prompt      - o    EMPTY >
<!ATTLIST prompt      %ids;
          name        CDATA        #IMPLIED
          type        CDATA        #IMPLIED
          itemid      CDATA        #IMPLIED
          xref        IDREFS       #IMPLIED
          text        %refid;      #IMPLIED
          fillin      %refids;     #IMPLIED
          menu        %refids;     #IMPLIED
          context     %refids;     #IMPLIED>


<!ELEMENT fillin      - o    EMPTY  >
<!ATTLIST fillin      %ids;
          property    IDREF        #REQUIRED
          text        %refid;      #REQUIRED
          name        CDATA        #IMPLIED
          type        CDATA        #IMPLIED
          itemid      CDATA        #IMPLIED
```

```
                xref·      IDREFS     #IMPLIED
                range      CDATA      #IMPLIED
                default    CDATA      #IMPLIED
                context    %refids;          #IMPLIED>


<!ELEMENT menu - o    EMPTY  >
<!ATTLIST menu        %ids;
                text       %refid;    #REQUIRED
                property   IDREF      #REQUIRED
                choice     IDREFS     #REQUIRED
                name       CDATA      #IMPLIED
                type       CDATA      #IMPLIED
                itemid     CDATA      #IMPLIED
                xref       IDREFS     #IMPLIED
                select     ( single | multiple )    "single"
                default    IDREFS     #IMPLIED
                context %refids;      #IMPLIED>


<!ELEMENT choice      - o  EMPTY >
<!ATTLIST choice      id   ID   #REQUIRED
                text       %refid;    #REQUIRED
                value      IDREFS     #REQUIRED
                context %refids;      #IMPLIED>



<!--**************************************************************
```

Context and Assertions

Every CDM composite object also has EMPTY Vehicle configuration, security level, and technician skill level are examples of context properties which determine the applicability of a particular data element to the situation at hand. "Context" consists of a set of frequently used "effectivity" attributes (security, config, track, version) , and a list of user-defined "precond" (preconditions).

"Precond" and "assertion" are both defined in terms of property-value pairs. A "property" is any "text" string which defines a property. A "value" is another "text" string defining the value. Property-value pairs may be asserted or tested by the run-time presentation software. An "assertion" on a para tag or step will be asserted whenever that para tag or step is performed. A "precond" is a test of a property previously asserted. The property element also has an "elmntref" attribute which

is an optional.attribute which may be used to indicate a prompt or
task which can be activated to acquire a value for the property if
none has been asserted.

```
*****************************************************************-->

<!ELEMENT context -o     EMPTY >
<!ATTLIST context    id    ID    #REQUIRED
          security  (uc | c | s | ts)    #IMPLIED
          restrict  NMTOKENS  #IMPLIED
          release   NMTOKENS  #IMPLIED
          codeword  NMTOKENS  #IMPLIED
          scilevel  NUMBER    #IMPLIED
          diglyph   NMTOKENS  #IMPLIED
          config    NMTOKENS  #IMPLIED
          maintlvl  CDATA     #IMPLIED
          track     NUTOKENS  #IMPLIED
          version   NUTOKENS  #IMPLIED
          valstat   CDATA     #IMPLIED
          verstat   CDATA     #IMPLIED
          precond   IDREFS    #IMPLIED
          context  %refids;        #IMPLIED>


<!ELEMENT assertion - o  EMPTY >
<!ATTLIST assertion id    ID    #REQUIRED
          property  IDREF     #REQUIRED
          value     IDREFS    #REQUIRED
          context   %refids;  #IMPLIED>


<!ELEMENT precond    - o  EMPTY >
<!ATTLIST precond  id    ID    #REQUIRED
          property  IDREF     #REQUIRED
          value     IDREFS    #REQUIRED
          polarity  ( pos | neg )  "pos"
          op    ( eq | lt | lte | gt | gte | in )   "eq"
          context %refids;    #IMPLIED>

<!ELEMENT property   -  o EMPTY >
<!ATTLIST property   id    ID    #REQUIRED
          text      %refid;   #REQUIRED
          elmntref  %refid;   #IMPLIED
          context   %refids;  #IMPLIED>

<!ELEMENT value      - o   EMPTY >
<!ATTLIST value      id    ID    #REQUIRED
          text      %refid;   #REQUIRED
          context %refids;    #IMPLIED>
```

```
]>
```

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